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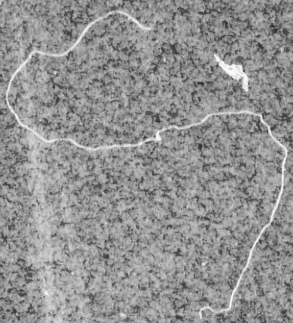

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SMITH SOUND AND ITS EXPLORATION.

BY DR. EMIL BESSELS.

A body of water of striking peculiarity separates Greenland from the American continent and its ice-bound archipelago extending towards the Pole. Its length of 1300 miles is equalled only by that of the Red Sea. Fully 600 miles wide at its southern entrance, with an average depth of 1500 fathoms between Cape Farewell and the northeastern extremity of Labrador, it gradually narrows towards the Arctic circle, having, however, between its bleak shores of metamorphic rock a width of not less than 150 miles. Thence it widens as far as Cape York. Narrowing again north of Jones Sound, the two coasts approach each other so closely beyond Cape Isabella and Cape Alexander, that one might be tempted to try sending a rifle-ball from the Greenland side to the opposite coast, with its steep mountain peaks, set off from their dark background by glittering glaciers.

This is Smith Sound, the discovery of which dates back to the early part of the seventeenth century. The treasures of India, which gave the incentive to attempts to find the northern passages, induced also a number of English noblemen and commercial adventurers to equip an expedition for the purpose of finding a northwest

passage. On the 26th of March, 1616, the Discovery, a craft of only 55 tons burden, commanded by Robert Bylot, with William Baffin as pilot, left Gravesend, with orders to follow the west coast of Greenland to the 80th parallel, and then to run southwest to the 60th parallel, in order to make the "Land of Yedzo."

On the 14th of May the vessel found itself in Davis Strait, latitude 75° 20′ N., and a week later it anchored in a bay on the "London Coast." On the 30th, Hope Sanderson was reached, the farthest point attained by Davis in 1587. Here extensive fields of ice were encountered, but they were successfully traversed in two days. A strong head wind compelled the navigators to anchor within a cluster of islands, to which they gave the name of Women Islands, from the fact that the Eskimo women showed more courage than the men, who, at sight of the strangers, decamped hastily. Keeping the coast of Greenland to the right, the navigators took a northerly course, but were soon stopped by ice, and were obliged to anchor in latitude 73° 45′ N., in a sound which they called Horn Sound, on account of the large number of narwhal tusks they obtained from the natives.

Sighting open water, the northerly course was resumed on the 18th of June. Baffin was delighted to find himself in an open sea, and believed that he had discovered the much-coveted passage. On the following day, in latitude 76° 35′ N., a high cape came in sight, which received the name of Cape Dudley Digges, and twelve leagues farther to the north a large sound was named Wolstenholme Sound, in honor of one of the patrons of the enterprise. In latitude 77° 30′ N., on July 4th, they ran into a strait which was named Whale Sound, on account of the many whales that were seen. Stormy weather compelled the navigators to anchor in a small bay, which they left before the following day, when they passed Hakluyt Island and discovered another sound, extending beyond the 78th parallel, where Baffin was greatly astonished to find a westerly variation of the compass amounting to not less than 56 degrees. This channel was named Sir Thomas Smith's Sound, and the islands in its meridian the Carey Islands.

As the compact nature of the ice-fields checked all farther progress towards the north, the explorers followed a southwest course, favored by a strong breeze. The fog, which had shut out everything from view for several days, disappeared on the 10th of July, when they found themselves close to the coast in Sir Alderman Jones Sound. An attempt to land proved impracticable on account of stormy weather; they therefore proceeded to the southward. Their hopes of finding the longed-for passage diminished from day to day; so

they decided to bear up for home, and reached England on the 30th of August.

Never before had fortune favored a navigator as it had the daring commander of the Discovery, who, on the memorable fourth day of July, attained the highest latitude west of Greenland, a latitude not again reached during the two following centuries. Unfortunately, the memory of this marine exploit was stained by the partiality of John Barrow, the English geographer, who credited only those discoveries that were made by officers of the Royal Navy. But even if the manuscript reports of Baffin had not been preserved in the British Museum, the reputation of Baffin and Bylot as naval heroes would still have been established by a subsequent English expedition, and the calumnies brought to light, as we shall see hereafter.

The wars which, at the beginning of the present century, preoccupied the European nations, had barely ceased when Arctic exploration was resumed. The English whalers visiting the Arctic seas having for three successive years reported on the favorable condition of the ice and the comparatively easy navigation of those seas, the English government resolved to send out two independent expeditions in search of the Northwest Passage; one, to push through Davis Strait; the other, through the sea east of Greenland. It suffices for our purpose to consider only the expedition which, commanded by John Ross, left England on the 25th of April, 1818, and followed in the wake of the Discovery. This expedition consisted of two well-equipped vessels, the Isabella and the Alexander; the former was commanded by Ross himself; the latter, by Lieutenant Parry. On the 1st of June they both entered Davis Strait and shaped their course along the coast of West Greenland. On the 22d they crossed the 70th parallel, after having been beset by ice the day before, and advanced slowly northward, making a hurried survey of the coast, which in several places they found to have been laid down almost ten degrees too far to the east.

Gradually they approached the scenes of Baffin's and Bylot's discoveries.* On the evening of the 17th August they sighted the

*Strange to say, this verification of the coast-line has never been mentioned by the writers of Arctic history, although Ross gives a very instructive and graphic representation of his surveys and of those of his predecessors. Compare Ross, Voyage of Discovery, frontispiece, where the coast of Greenland is represented in solid and dotted lines.

Cape Dudley Digges of the Discovery, and on the following afternoon, in Wostenholme Sound, Ross attempted to land, but was prevented by a dense fog. However, towards 9 o'clock the Carey Islands came in sight, corresponding exactly with Baffin's description. The sea was comparatively free from ice, but the violence of the wind from the north prevented him from landing.

Cruising in the vicinity of the islands during the night, the vessels found themselves at 8 o'clock on the morning of the 19th opposite the western coast of the group; they then started on a northeasterly course to examine more closely Wolstenholme Sound. Satisfied that farther progress in this direction was impossible, Ross returned to the Carey Islands to take on board the officers whom he had left on an ice-field to make astronomical observations.

At midnight of the 19th the expedition reached its highest point, which Ross gave as in 76° 51′ N. latitude, 74° 20′ W. longitude; but the absence of reliable astronomical observations may possibly have caused some inaccuracy. The 77th parallel, however, which had been bravely crossed by Bylot and Baffin, was hardly reached by Ross, although his ships were strong men-of-war; and no new laurels were won by the commanders until the following year, when Parry performed a daring exploit. Smith Sound was sighted by Ross, who designated it a *cul de sac*, and on his charts conjured up imaginary mountain ranges barring a northerly exit. In the same manner he treated the sounds bearing the names of Jones and Lancaster.

Although considered a failure, this expedition, returning to England on the 30th October, was not without some good results. Evidently its greatest success lay in the fact that it induced England to engage in new enterprises which became of vast importance to the geography of the Arctic region, and tended to increase our knowledge of the north coast of America and its islands. The more special results were: the discovery of the red snow which gave name to the Crimson Cliffs; a greater knowledge of those Eskimos who extend their wanderings into Smith Sound; some soundings, and the mapping of some portions of the coast.

Unfortunately, Baffin's original chart has been lost, but Petermann very ably drew an outline of the cruise from the descriptions found in the old manuscripts. A comparison of this chart with the representation of Ross's survey north of the 75th parallel must elicit our admiration for the work of the old navigators. And we ought to excuse any uncertainty of the geographical positions, for it must be remem-

bered that in those times, only the infrequent eclipses of the sun or of the moon could be used for accurate determinations of longitude; and, in consequence of the imperfection of the nautical instruments of those times, it was not until sixty years later that the occultations of the satellites of Jupiter could be utilized; even the dimension of a degree of longitude at the equator had not then been exactly determined.*

The Bylot-Baffin survey, considered in its entirety, gives by far a more correct representation of the northern outlets of Baffin's Strait than the chart of Ross, which was magnificently engraved on copper in artistic style, but which owes many of its interesting details to mere imagination, which created mountains in places that Ross intentionally or unintentionally did not reach. A critical comparison of his work with that of his successors will show that many of the localities named by him have no existence. If any one will take the trouble to compare the conflicting descriptions, he will be convinced that such is the case; for instance, Cape Isabella and Cape Alexander, flanking the entrance of Smith Sound, cannot possibly be the same capes as those to which Ross gave the same names. For more than two centuries they had been the northern Pillars of Hercules, and they were destined to hold this position for a quarter of a century more. In the meantime, steam power had taken its place in navigation.

* The accuracy of the geographical positions determined by Bylot and Baffin may be due to the circumstance that these navigators perhaps used an astrolabe instead of a cross-staff to measure solar altitudes. Inasmuch as their vessel was frequently surrounded by ice, there was nothing to interfere with the reliability of the former instrument. For the ice acts like a breakwater, entirely deadening the swell, and a good astrolabe, according to the statement of Tycho Brahe, read to one-sixth of a minute of arc. In the latitude where the navigators made their surveys, the meridian altitude of the sun did not exceed 45°. At that time the tables of refraction commonly in use were those published by Tycho, which were based on the erroneous supposition that altitudes higher than 45° were not influenced by refraction. Consequently, they avoided errors which, in some instances, especially in high latitudes, could easily amount to a minute of arc.

To demonstrate further the accuracy of the observations made by Bylot and Baffin, I will only state that astronomers like Regiomontanus and Peurbach made latitude observations which were 26′ (Venice) or even 27′ (Nuremberg) in error (see Alfontii Regis Castellae Tabulae, impr. Erhardus Ratdolt). Their instruments were certainly not less perfect than those of the English navigators; for, up to the time when Hadley invented the octant, the nautical instruments were very little different from those of the Arabs and the ancient Greeks.

Subsequently to the Ross expedition, the English government, still searching for the Northwest Passage, sent out in 1847 the expedition under Sir John Franklin. Alarmed by his long absence, Lady Franklin in 1852 sent to his rescue a small steamer, the Felix, under Commander Inglefield. The instructions of Inglefield were to take provisions to the English squadron in Barrow Strait, and then to search for the lost navigators in the northern extremity of Baffin's Bay. This vessel, with a crew of seventeen persons, including the commander, left the Thames on the 4th of July, 1852, the same date as that on which Bylot and Baffin reached their highest latitude. On the 20th of August it made Cape York. On the following day the explorers landed at the Eskimo settlement in the vicinity of the Petowak glacier, and, two days later, at North Star Bay, and, on the 25th, at Bardin Bay. Thence, penetrating through Smith Sound, they reached latitude 78° 28′ 21″ N. on the 27th of August. Inglefield had thus exceeded Bylot's and Baffin's latitude, and saw before him an apparently open sea; but, on accoun. of stormy weather and the advanced season, as well as the insufficient preparations for wintering his small vessel, he was compelled to return.

The most northerly land that he sighted on the east coast of the sound was in about 79° 32′ N. latitude. He represented it as a projecting cape, and named it after Frederick VII. of Denmark. The most northerly point on the west side, in about the same latitude and in W. longitude 79°, was named Victoria Head; while a small island, situated about midway between these two positions, which, however, was never again seen, was named Louis Napoleon.

Considering that Inglefield spent scarcely fourteen days in that region, we are astonished at the large amount of valuable material which he and his scientific companion Sutherland collected. Geographical knowledge was enriched by the survey of about 180 miles of coast-line; terrestrial physics, by a valuable meteorological record and numerous hydrographic observations; and, lastly, natural history profited by their collections.

On the 1st of September the explorers proceeded to Jones Sound, running in a westerly direction; on the 2d they left for Lancaster Sound, and on the 10th of November the little steamer was once more anchored safely in Peterhead.

The first expedition that entered Smith Sound fully prepared to winter, sailed under the American flag, and attained a higher latitude than any of its predecessors. It was commanded by Elisha Kent Kane, an officer of great energy, whose health was so much impaired by this campaign that he died soon after his return.

The expenses of the first American Franklin Expedition were defrayed wholly by Henry Grinnell; those of the second were sustained by him in conjunction with Mr. George Peabody. The United States Navy, of which Kane was an officer, furnished ten men and a portion of the equipment. The Advance left New York, May 30, 1853; her crew consisted of eighteen men, including the commander. After touching at St. John's, Newfoundland, the explorers arrived at Fiskernaesset on the 1st of July and at Upernivik on the 17th. Here they obtained a supply of furs and dogs and secured the services of a Dane and an Eskimo. Ten days later, Wilcox Point was passed, and, soon after, the explorers entered Melville Bay. The ice along the shore was rotten and threatened to break up. Kane, therefore, in preference to the ordinary course along the edge of the ice, took the middle passage until stopped by heavy floes. He then coasted to Cape York, doubling it ten days later, and entered Smith Sound on the 7th of August. As far as the eye could see, there was open water to the northward, with a promising swell from the same direction. The wind was variable, blowing mostly fresh from the south and west.

Aside from the difficult task of towing the vessel through the heavy ice, the voyage had been favorable, and with new hopes the explorers sighted the open sea. Their joy, however, was of short duration; the wind veered and blew strong from the north; and, nearing Inglefield's Littleton Islands, the pack was observed a short distance ahead. On the largest of the islands Kane erected a cairn, within which he deposited information regarding the success of the expedition; and *cached* a boat with provisions on a peninsula, to provide for the contingency of the disabling of the vessel.

In order to proceed farther it was necessary to force a passage. The first attempt was made during the night of the 7th. The ice was very thick and apparently several years old; therefore but little progress was made. About forty miles north of the place where the depot had been established the vessel came to a stop. The ice closed around it, and it was saved from going ashore only by an eddy. The danger during the next three days was imminent, but on the 13th the Advance succeeded in escaping to the westward. But here, too, the

ice was unexpectedly heavy; the days grew shorter, and it was feared that winter would set in and leave them to the mercy of the drifting pack.

Amid these difficulties the Advance reached her most northerly position, 78° 43′ N. latitude, on the 29th of August. She was damaged to a considerable extent; the bulwarks were partly demolished, the bow and one of the boats were stove, and more than 600 fathoms of cable with one of the anchors had been lost. The crew worked with unremitting zeal until the 1st of September, but to no purpose. The brig was sheltered in a bay along the coast, and Kane, accompanied by some of his men, advanced northwardly by boat and sledge to reconnoitre the condition of the ice. From an elevation of 1100 feet he could overlook the sea to the 80th degree, and he found it frozen solid, with numerous icebergs.

Fully convinced that farther progress by vessel was out of the question, Kane returned to the brig, and found the shelter he was in sufficient for the time being; deciding therefore to establish his winter quarters at this point, he commenced preparations at once. Later on, he sent a sledge-party for the purpose of establishing a depot as far north as possible, to aid in the journeys contemplated for the next spring. Two shorter explorations were made; one into the interior of the country for the purpose of reconnoitering, and the other to a point, northerly, on the coast, to deposit a self-registering thermometer.

Kane named his winter-quarters Rensselaer Harbor, and here an observatory was erected, the position of which was determined as N. latitude 78° 37′ 04″, and W. longitude 70° 52′ 45″. Never before had an expedition supplied with proper instruments wintered in so high a latitude, and we may therefore justly consider the magnetic and meteorological observations made during Kane's stay in Rensselaer Harbor as important contributions to terrestrial physics, and the series of astronomical observations may be regarded as equally valuable.

The sun disappeared on the 10th of October and remained below the horizon for 120 days. The sanitary condition of the crew was excellent, but a great mortality prevailed among the dogs, of which fifty-seven died, the pack being reduced to a very small number. As the execution of Kane's plan of operations depended almost exclusively on these animals, it was a very fortunate circumstance that in April a band of Eskimos visited the harbor, from whom Kane obtained an additional number.

Low temperatures delayed the sending out of sledges until the second half of March. On the 19th a small party started to establish

a depot at a distance from the vessel of ten days' journey. In the meantime, preparations were pushed forward to get ready the principal exploring party, whose object was to search for traces of Franklin along the northern prolongation of the sound. Three of the men sent out returned quite unexpectedly in a deplorable condition on the 31st. Cold and hunger had almost deprived them of speech, and it was a long time before they were able to give an account of their companions. They had left them somewhere north of the brig, between the hummocks. Four of them were helpless, perhaps frozen, and a fifth, in tolerable condition, had remained behind to nurse them. When they started to obtain help a severe snowstorm had set in. That was all the exhausted men were able to tell, after risking their own lives to obtain help and assistance for their comrades. Without delay, Kane had a sledge equipped, and the man who had suffered least was enveloped in buffalo skins and tied to the sledge, to serve as a guide. Kane, with nine men pulling the sledge, started. The thermometer read 43 degrees below zero. It became, therefore, necessary to proceed with all possible speed to save the lives of the others. Unfortunately, Ohlsen, the man on the sledge, who had marched fifty successive hours without food, and who was now perfectly exhausted, commenced to show indications of delirium and could give no answer to questions put to him. The party proceeded at random after having been on the march eighteen hours. Kane ordered the men to disperse, leaving the sledge behind. The experienced eye of the Greenlander Hans discovered a trail, which he and Kane followed for a couple of hours, when they noticed a flagstaff, from which the Union flag and a little Masonic banner floated. Close by the tent, completely covered by drift snow, the men were found alive, but their hands and feet were frozen, so that they were unable to move. After resting a short time, the sufferers were sewn up in furs, packed on their sledges, and, by hurried marches, the party returned to the brig. The temperature fell to —48°; the men had recourse to snow to quench their thirst. All were attacked by that irresistible sleepiness which intense cold generally produces, and it was only by the energetic exertions of the leader that they were saved from freezing. They returned to the harbor after an absence of eighty-four hours, during which they had had only four hours' rest. Two of the men died soon after the return, and most of them lost portions of their extremities by amputation. All suffered from brain affections, which resembled temporary insanity, and all were confined to their beds for a long time.

It was not until the end of April that the health of the crew permitted any travelling. After despatching a small number with provisions, Kane, accompanied by one man, started on the 27th in a dog-sledge on a journey northward. The ice was almost impassable and progress difficult. On the 29th he came to the sledge that had been sent forward with provisions, but the way grew worse. Scurvy appeared among the crew. One after another became incapacitated, and the expedition again failed. Kane himself was so weak that he had to be carried over the worst places, while on a level road he had to keep to his sledge. Returning to the brig on the 14th of May, he became unconscious.

Under these circumstances, however, he had no time to be sick; his active mind thought of new means to accomplish the object of the expedition. The ice to the north having proved impassable, he despatched, on the 20th of May, a sledge that was to cross Smith Sound south of the harbor, and to penetrate northward along the west coast. This expedition was entrusted to Dr. Hayes, accompanied by one seaman. Instead of following Kane's instructions, Hayes at once struck northward, and was so fortunate as to approach the coast on the 25th, in latitude 79° 24′. After having overcome the greatest obstacles, the travellers found themselves affected with snow-blindness; on the 26th, Hayes' companion became wholly blind; on the following day the dogs gave out, and finally the sledge broke. Undaunted, the discoverers continued their northward march; on the 27th, in W. longitude 69°, they reached their highest latitude, 79° 45′. After making a hurried survey of the coast, they returned, reaching the brig on the 1st of June, after an absence of twelve days.

This expedition gave a fair account of the coast line of Grinnell Land as far north as the 80th parallel; but the west coast of Greenland was still shrouded in mystery. Notwithstanding all the exertions, it had not been possible to reach the northern side of the great Humboldt Glacier, that immense wall of ice, which, commencing at Cape Agassiz, beyond the 79th degree, extends north as far as the eye can reach.

On the 4th of June, Morton was directed to solve this problem. After preparing his stock of provisions, he left the depot on McGary Island on the 18th, in a sledge, accompanied by the Greenlander Hans. The detachment that had accompanied him thus far returned to the brig, and the others started on their northward journey at half-past-twelve in the morning. Soon after setting out, they

found themselves in the labyrinth of icebergs which on a previous occasion had prevented the progress of one of Kane's expeditions. Frequently, in order to find an outlet from one of the "blind alleys" into which they had ventured, they found themselves compelled to turn back, after having accomplished a mile or more to the north; frequently they had to bridge over wide fissures in order to proceed. The difficulties increased, but they continued in their onward march. On the morning of the 20th they sighted land to the west, an indication of the narrowing of the sound. Thus far they had moved in the direction of the great Humboldt Glacier without seeing the opposite coast. An observation at noon of the 21st showed them that they had gone one mile beyond the 80th degree of latitude; both shores were visible; they had reached the northern side of the glacier, and in front of them steep rocks formed the continuation of the picturesque coast. There they deposited one-half of their supplies in a cave and continued on their course. Towards evening they saw open water at a distance, while flocks of eider-ducks, geese, and dovekies rose in the air, and from the cliffs the cries of the burgomaster and ivory gulls were heard. The ice became thinner and bent under the weight of the sledge; the terrified dogs refused to proceed, and it was only with great difficulty that the sledge could be saved from breaking through before they reached the firm ice. During the 22d, fifty miles were covered, and they succeeded in crossing the icy barrier that skirted the coast. On the opposite side, Grinnell Land appeared to extend northward in a straight, unbroken line. A severe storm prevented the continuance of the journey until the morning of the 23d; and then they had hardly proceeded six miles when the shore ice disappeared. Leaving the sledge, the travellers worked their way over floating pieces of ice, and after proceeding about four miles they sighted towards the north a projecting cape and an island. They then returned to the sledge.

On the morning of the 24th the attempt was renewed, but the difficulties proved greater than on the preceding day. The way grew worse, and finally the travellers were compelled to creep over the narrow shelves on small projections of the cliff. The belt of ice had wholly disappeared; only isolated pieces were floating on the dark waters, and were breaking up noisily as they crashed against the rocks at the feet of the travellers. From the north a swell was observed, indicating proximity of open water. They failed in their attempt to reach the cape, which they named Cape Constitution. Hans grew

tired and fell behind. Morton ascended a slope of about five hundred feet in the vicinity of another cape (Cape Independence), and saw before him an apparently open sea, and in the northwest the horizon covered with dark rain-clouds. Northward, disappearing in perspective, the coast of Grinnell Land could be traced, the most distant point of which (Cape Parry) he estimated to be in N. latitude 82° 30′.

After once more attempting to double the cape, the travellers returned to the sledge on the 25th. A meridian altitude of the sun on the next day determined the position of the camp at 80° 20′; but as Morton estimated his northward journey twenty miles farther, he had reached N. latitude 80° 40′.* In the vicinity of his camp he noticed a strong southerly current. A brisk northerly wind swept through the channel, but no ice was visible. At four o'clock in the afternoon of the 26th the travellers retraced their steps and returned to the vessel, reaching it on the 4th of July.

It is probable that subsequent exploration of the Smith Sound region would have resulted differently if Kane had been satisfied to publish the simple report of Morton, from which the above account has been taken. The same might be said if an excellent paper by Rink had received due weight (see Journal of the Royal Geographical Society, vol. XXVIII., on the discoveries of Dr. E. K. Kane, 1853–55, by Dr. H. Rink). Kane, with an adventurous turn of mind, which may be recognized on every page of his narrative, clothed the observations of Morton with adventitious colors, which has led uncritical minds to accept this account literally. It would be unjust in the extreme not to acknowledge his merit. But it certainly was not an important gain to geographical science to have him proclaim the existence of a polar sea, kept open by the warm waters of the Gulf stream.

* Kane placed Cape Constitution, which is scarcely five miles north of Cape Independence, in latitude 81° 22′ N., almost twenty-two miles farther north than he was justified. Morton, on his northern journey, took astronomical observations and kept an itinerary in which he noted the estimated distances travelled. Instead of using the former, Kane took the mean of the two, thereby giving rise to various errors; for, a person not very much experienced in Arctic travel will invariably overrate his distances.

Five years after Kane's narrative had been published, the Smithsonian Institution issued a volume containing the astronomical observations made during the expedition, whereby the original chart was greatly changed. (Compare Physical Observations in the Arctic Sea, by E. K. Kane, reduced and discussed by C. A. Schott, Washington, 1859–1860).

How far the final positions given therein are correct, we shall see hereafter.

Kane, in his official report to the Secretary of the Navy, gives the following summary of the geographical results hitherto obtained by his different sledge-expeditions:

"1. The survey and delineation of the north coast of Greenland to its termination by a great glacier.

"2. The survey of this glacial mass and its extension into the new land named Washington.

"3. The discovery of a large channel to the northwest, free from ice, and leading into an open and expanding sea, equally free. The whole embraces an iceless area of four thousand and two hundred miles.

"4. The discovery and delineation of a large tract of land forming the extension northward of the American continent.

"5. The completed survey of the American coast to the south and west as far as Cape Sabine, thus connecting our survey with the last determined position of Captain Inglefield, and completing the circuit of the straits and bay heretofore known at their southernmost opening as Smith Sound."

The discoveries of subsequent expeditions to Smith Sound will furnish us the means of testing the correctness of this statement.

With Morton's sledge-journey the geographical labors of the expedition may be considered as closed. Only a few unimportant discoveries were made after that, but we must record a chapter rich in disasters, sufferings, and daring deeds. The vessel was provisioned for only one year and a half; and yet at the expiration of a twelve-month the brig was still fast in the ice. On the 12th of July, Kane, accompanied by a small but picked crew, started on a boat-journey to inform the commander of the English squadron of his condition. He counted on the presence of an English vessel in the vicinity of Beechy Island, near the entrance to Wellington Channel, a distance of more than four hundred miles. On the 6th of August he returned to the brig, but without having accomplished his object. The heavy pack south of Cape Parry had frustrated every effort. There was no prospect of freeing the vessel during the year 1854, and he at once commenced making preparations to winter a second time. This required more than ordinary courage and devotion; for, the provisions and fuel had almost been consumed and the resources of the country were extremely scant. Besides, the health of the party had sensibly declined; their physical energies were weakened. Only fifty gallons of seal oil had been saved from the summer's hunt; the dried fruits seemed to have

lost their efficacy, and the store of molasses was reduced to a minimum. A single apartment was bulkheaded off amidships as a dormitory and abiding-room for the entire crew; and a covering of moss, gathered with great difficulty from the frozen cliffs near the harbor, enclosed it like a wall. A similar cover was placed on the deck. The explorers, as far as possible, adopted the habits of the natives; they dressed entirely in skins, and organized daily hunting-parties which were hardly ever successful. The nearest winter settlement of the Eskimos at that time was about seventy-five miles distant by dog-journey; but, nevertheless, the ice-bound crew of the Advance entered into regular communication with the good-natured natives, from whom they now and then obtained some bear-meat, seal, and walrus, which were eaten raw. A small party of the crew, who, towards the end of August, had made an attempt to reach one of the Danish settlements, returned to the vessel after more than three months of intense sufferings. The noble commander gave them a brotherly welcome and shared with them what remained of the stores, although at the time of their leaving the brig to seek more genial surroundings he had allotted to them already more than cold prudence would have dictated to a man less generous than Kane.

After the gradual return of daylight the commander finally determined to abandon his vessel. Scurvy, with varying phases, had prevailed among the heroic little band. For many days Kane and one of the officers had been the only persons able to carry on the daily work and to attend upon the sick. They were even deprived of the services of the surgeon, whose frost-bitten toes had to be amputated.

The organization for their escape was matured with the greatest care. Three boats—two of them whaleboats twenty-four feet long, and a light cedar dingy of thirteen feet—were supplied with runners, cut from the cross-beams of the vessel, and bolted, to prevent them from breaking. These runners were eighteen feet in length and shod with hoop-iron. No nails were used in their construction; they were lashed together, so as to form a pliable sledge, and upon it the boats were so cradled as to be removable at pleasure. Another sledge, with a team of dogs, was reserved for carrying the stores, and also for the transport of the sick, four of whom, on the 18th of April, were still unable to move. About thirty-five miles southward of the brig there was an old deserted Eskimo hut. This was fitted up to serve as an entredepôt of stores, and as a wayside shelter for those of the party who were already broken down or who might yield to the first

trials of the journey. The cooking utensils were very primitive. They were made of an old stove-pipe, and consisted of simple soup-boilers, enclosed in a cylinder to protect them from the wind. A metal trough filled with fat and provided with wicks of moss and cotton canvas formed the stove. The provisions, with the exception of tea and coffee and a few small stores for the sick, consisted exclusively of melted fat and powdered biscuits. They were packed in water-proof bags, adapted in shape to the sheer of the boats, and in no case rising above the thwarts.

The clothing was limited to a fixed allowance. Moccasins for the feet were made of woollen carpeting, and numerous changes of dry blanket-socks were kept for general use. For bedding, to the few buffalo robes left were added eider-down coverlets. Varied experience gained on former trips had taught the leader that, next to diet and periodical rest, good bedding and comfortable foot-gear were the most important things to be considered.

Kane himself transported the sick and the invalids, besides the reserve of provisions. The first load of stores was carried south in April, by the only dog-team at the disposal of the party; and on the 15th of May the invalids were removed. By the middle of June all the disabled men and some twelve hundred pounds of stores had in this manner been transferred by a series of journeyings equal in the aggregate to a distance of eleven hundred miles. Two days later the sledge-boats left the vessel, dragged by the officers and men. The natural history collections were also carried as far as the sick station at Anoatok, but the weary travellers had to abandon them there for want of room. It was only with the utmost difficulty that they could carry the chronometers and such magnetic and meteorological instruments as might allow them to verify the observations made in winter-quarters and at different other stations. The more bulky apparatus, as well as the library, had to be left behind. Only the log of the vessel and the various documents of the expedition could be given a place in the boats. The distance made good during the first week was scarcely fifteen miles, and, although the rate of transportation was afterwards increased, it never exceeded three and a half miles a day over the ice, involving from twelve to fifteen miles of actual hard travel. To sustain the party, Kane found it necessary to return from time to time to the vessel, and to make dog-journeys to the southern settlements of the Eskimos. The last visit to the brig was on the 8th of June, for the purpose of procuring some pork to serve for fuel.

She was then in the same position as when abandoned on the 17th of May: "the same ice was around her still."

In the effort to liberate one of the sledges, which had broken through the decayed ice, Ohlsen, the carpenter of the party, received such serious internal injuries that he died on the 12th of June. He was buried on Littleton Island, opposite a cape now bearing his name.

Assisted by the friendly Eskimos, the party reached the margin of the floe six days later. During thirty-one days they had walked three hundred and sixteen miles, and had dragged their boats over eighty-one miles of rough, unbroken ice. The passage to Hakluyt Island was open, but as far as Cape York they met with nothing but solid pack, hanging around Murchison Sound and stretching to the westward. Passing over the solid land ice, they advanced only one hundred miles between the 20th of June and the 6th of July. On the 21st, Cape York was finally doubled, and, finding no natives, the explorers made immediate preparations to cross Melville Bay. Up to the 26th they followed the margin of the fast floe, resorting only twice to portage.

On the 6th of August, eighty-three days after they had left their desolate winter-quarters, they reached Upernivik, welcomed by the hospitable Danish officials, who provided for all their wants. They had already taken passage on board of the Danish trading-brig Marianne, to be landed at the Shetland Islands, when, touching at Disco, they were met by the vessels sent in search of them by the government. These, the United States barque Release and the steamer Arctic, commanded by Lieutenants Henry Hartstene and Charles C. Simmes, had penetrated as far north as 78° 32′ and had then fallen in with a band of Eskimos, who informed them that Dr. Kane, in company with his interpreter and seventeen others, had gone south in their boats. On the 11th of October, 1852, both vessels anchored at New York, restoring the explorers to home and friends.

The next expedition sent out to explore Smith Sound was likewise due to American enterprise. It was commanded by Dr. Isaac I. Hayes, who, as Kane's surgeon, had fully shared the fortunes of the Advance. After five years of incessant work in the attempt to arouse the interest of the public for the continuation of Arctic exploration, he finally succeeded, by the help of warm personal friends and scientific societies, in fitting out and provisioning the schooner United States, a craft of only 133 tons burden. With the intention of completing the

surveys so ably begun by Inglefield and Kane, he combined the purpose of attempting to reach the pole itself by way of Smith Sound, which he considered "one of the most promising gateways to the Open Polar Sea."

On the 6th of July, 1860, the vessel left Boston harbor with a complement of only fifteen persons, including the commander. Having crossed the Arctic circle on the 30th, they sighted the coast of Greenland on the following day in the latitude of Disco. Six days later they were at anchor at Pröven, a small Danish colony, where they expected to purchase the necessary dogs; but, being unable to do so, they pushed around to Upernivik, where they arrived on the 12th of August. Here the explorers buried the ship's carpenter, who had died of apoplexy during the previous night, and procured a number of strong dogs and six additional persons, half of whom were natives.

The colony was still in sight when the vessel encountered a line of icebergs of various shapes and dimensions. They seemed to be endless and numberless, and so close together that at a little distance they appeared to form a solid wall; but they were passed in safety. On the 21st a stop was made at Tassuissak, the northernmost settlement, inhabited by a few white men, and situated in latitude 73° 21′ N., longitude 56° 5′ 7″ W., and about one hundred and sixty miles north of Hammerfest, the *ultima thule* of civilization in the northern hemisphere. The commander intended to spend only a few hours at the place, but while the men were searching for sledge-dogs, a large quantity of ice closed the mouth of the harbor. Finally, on the evening of the next day the tide carried off the pack, and shortly afterwards the little schooner passed Cape Shackleton and the Horse's Head, and shaped her course for Melville Bay. By eight o'clock in the morning of the 23d of August, Wilcox Point was clearly in view, and the Devil's Thumb showed itself, partly hidden by floating clouds.

There was scarcely any ice in sight, except a few bergs with water-worn sides and rugged pinnacles. Melville Bay, apparently open, spread itself before the explorers. Up to that time a light wind had been blowing from the eastward, setting the pack toward the American side; a heavy swell was soon noticed, coming from the south and accompanied by a blinding snowstorm. The air was so thick that one could not see to a distance of ten yards, and it blew half a gale; still the schooner's head was pointed toward Cape York and the vessel went on her way under close-reefed sails. When it cleared again

the vessel lay becalmed not far from the centre of Melville Bay; the sea was dotted with icebergs, but there were no fields in sight. A quantity of the latter mixed with loose pack was met at noon of the 25th in latitude 75° 53′ N., but was successfully passed. Fifty-five hours after the explorers entered Melville Bay, they found themselves in the North water, standing close in under Cape York, with its snow-crowned highlands. A careful lookout was kept for natives. Passing along the coast within a rifle-shot's distance, the explorers soon noticed a group of human beings making signs to attract attention. A boat was lowered and a party landed to communicate with these Eskimos. Hans, whom Kane had taken on board his vessel in South Greenland, and who had deserted the brig to live with the wild Itah tribe, was among them. He instantly recognized Hayes and Sonntag, who had been the astronomer of Kane's expedition. Hans was accompanied by his young wife with a babe in her hood, and by several members of his family. He was anxious to leave his self-imposed banishment, and Hayes took him with his wife and child on board the schooner, which was reached early in the evening.

The wind having freshened, they set sail, and at eight o'clock were abreast of Booth Bay, the winter quarters of the small party who had left the Advance in 1854, and, led by Hayes, had made the fruitless attempt to reach one of the Danish settlements. Soon afterwards the sky became overcast, more heavy snow began to fall and the wind died away. Passing Whale Sound outside of Hakluyt Island, they sighted the entrance of Smith Sound on the morning of the 27th, and found a passage through the pack near the shore, off Cape Saumarez. Cape Alexander was reached without any difficulty, but not so the coast of Grinnell Land, towards which they now were standing. Large masses of ice were drifting down the sound before a northeasterly wind. Many of the floes were from two to ten feet above the water; the ice seemed to be interminable; not a single lead could be discovered in the direction of Cape Isabella.

Now, the northeast wind grew to a gale, and compelled the vessel to seek shelter near the shore. Not until three o'clock on the morning of the 30th did they come to anchor in a little cove near Sutherland Island. The stern of the vessel was swung round and moored to a rock, but the hawser parted, under the influence of a violent squall, and the schooner was lying to her bower and kedge with thirty fathoms of chain. After the gale had abated, the sea, from an elevation of 1200 feet, appeared to be free from ice along the shore as far

as Littleton Island, from which the pack stretched out over the North Water as far as the eye could reach. There also seemed to be open water about Cape Isabella, while beyond the cape the ice was solid.

The night of the 31st closed upon a day of disaster. The schooner was dragging her anchors; while the bower was saved, the kedge caught a rock. In a critical moment the hawser parted and the schooner was driven upon some bergs grounded astern. The stern boat was crushed, the bulwarks over the starboard-quarter were stove in, and, the schooner's head swinging round, the jibboom was carried away. The bowsprit and foretopmast were both sprung. But the vessel at last escaped, and under bare poles scudded before the wind. Shortly afterwards, when the pack and a vast number of icebergs came in sight, the explorers made sail; but the mainsail was blown away as soon as it had been set. They had before been blown of the sound, and now this happened again. In the attempt at wearing the schooner, to avoid an iceberg, the fore-gaff broke, and, unable to carry anything but a close-reefed staysail, they found shelter near Cape Alexander.

Undaunted by these failures, Hayes, during the next two days, repaired damages, and again pushed northward. The southern margin of the pack had remained unchanged, but there was some open water between Cape Hatherton and Littleton Island. There the vessel entered the ice. After proceeding ten miles in a northwesterly direction, the channels closed up under the combined influence of a south wind and strong southerly current. The vessel fought nobly against the floes, which were pouring down the sound, but with little success, although all possible sail was crowded on. Owing to the accident to the topmast she could not carry any topsail, and therefore would work only slowly in stays. The danger of being nipped was great. In wearing round without having sufficient room, her starboard bow almost struck an ice-field a mile in width. Escape was impossible; so the helm was put up that she might take the shock squarely on the fore-foot, and when the collision took place the bows were deprived of their strong iron sheathing, and the cut-water flew in splinters. Clear of the floe, the schooner came again to the wind, and, through a narrow lead, emerged into one of the broader spaces of open water. Hayes was bound to get a clutch on Cape Hatherton as long as the vessel would float; but fate was against him. The ice closed in with the land, and the explorers were fast losing ground, as

before. Ere an hour had elapsed the schooner was fairly beset. She had been worked into a triangular space, formed by the contact of three fields, which now closed upon her like a vice. The deck-timbers were bowed up, the seams of the deck-planks opened, and her sides threatened to give way. Finally the ice hummocked under her bilge on the port side and lifted her partly out of water. During eight anxious hours she was kept in this position; then the ice relaxed and she gradually sank back. An inspection showed that the rudder was split, two of its pintles were broken off, the stern-post was started, and fragments of the cut-water and keel were floating alongside. Besides, the hold was rapidly filling with water.

The pumps having been manned, she was headed for Hartstene Bay, where she anchored. After it had been found that her damages were not so serious as had at first been supposed, and after the most necessary repairs had been made, she was again taken to sea. But owing to her crippled condition she had to be handled gently. Further progress north was now impossible. Hayes, therefore, on the 6th of September, turned back to Hartstene Bay and anchored in a small, well-protected harbor, which he named Port Foulke. For the position of the observatory subsequently erected he gives lat. 78° 17′ 39″ N., long. 73° 00′ W.*

If daring and enterprise alone could crown Arctic expeditions with success, Hayes would certainly have won imperishable laurels. But fortune refused to smile upon the harassed explorers, and notwithstanding all their earnest efforts they did not succeed in reaching a higher latitude than Inglefield had reached eight years before. When the temperature fell 50° below zero the crippled little schooner was fairly imbedded in her icy cradle. Meanwhile the cargo had been landed and taken to a small storehouse, built of erratic boulders found along the terraced beach, and roofed with sails. The hold of the

* Latitude 78° 18′ 30″ will be found to be more correct. In order to obtain the chronometric difference between Polaris House and Port Foulke, Mr. R. W. Bryan, Astronomer of the U. S. North Polar Expedition, was sent to the latter place on May 23d, 1873, to take some observations on the spot where Hayes' observatory had stood. As it was supposed that the latitude determined by Hayes was correct, it was not deemed necessary to redetermine the same. There is, however, a set of 15 double altitudes of the sun measured under very favorable conditions, about 2½ hours from the meridian, from which the latitude here given has been deduced. The observations were taken with a Gambey sextant, reading to 10″.

vessel was converted into quarters for the crew, and by the first of October it was ready for use. Mr. Sonntag, the astronomer of the expedition and second in command, with the help of his assistant, set up the different instruments, which now were in fair working order. Where Kane's half-starved hunters had in vain searched for game, Hayes found it in great abundance, the sportsmen hardly ever returning empty-handed. In the course of October they shot not less than seventy-four reindeer, twenty-one foxes, twelve hares, one seal, besides some thirty geese and other aquatic birds. They commenced the winter with a most encouraging prospect for an abundant commissariat, and everything looked bright and happy.

But soon all these fair prospects were changed, and various new mortifications and disasters awaited the explorers. Before midwinter had set in, most of the dogs had succumbed to the epidemic disease common amongst Eskimo dogs, and whose origin and nature are yet but little known. This malady broke out very suddenly. Up to the first of December the animals had been in perfect health; and, as they had been fed on an abundant allowance of fresh meat, Hayes was confident that he could carry them through to the spring. His fears, however, were for a time somewhat excited by the information received from Hans that the Eskimos of Whale Sound and vicinity, with whom he had been living, had sustained heavy losses by the death of a great number of their animals, and the description that he gave of this distemper corresponded with that observed in Southern Greenland. But as November passed and no symptoms of the malady had been noticed, he was hopeful that the dogs, upon which a great deal of the success of the expedition depended, would escape the visitation. The damage that Dr. Kane had suffered by the loss of his teams was still fresh in Hayes' recollection, but in this instance the cause of death seemed apparent. Kane had fed his teams almost wholly upon salt meats, which, giving scurvy to the men, could hardly be expected to act otherwise than injuriously on the animals, which had been used to a diet of fresh seal meat. During the first two weeks of December alone, Hayes lost eighteen dogs, which left him with only twelve; and these, one week later, were reduced to nine, and it seemed likely that the remainder of the pack would also die. Sonntag, therefore, volunteered to open communication with the Eskimos of Whale Sound, which had to be done at the earliest date. So he left on the 21st of December, accompanied by Hans, who drove his team.

A full month elapsed, and several days of the January moonlight, but still the travellers had not returned. The little band on board the schooner had grave cause to be alarmed. Sonntag and his companion must either have met with an accident or they must have been detained among the Eskimos in some unaccountable manner. Hayes, therefore, began to devise means for ascertaining what had become of them. After having sent out different parties to look for tracks in the snow near Cape Alexander, he concluded to search in person. A sledge to be drawn by men was ready and laden as early as the 27th of January, but a gale prevented the voyagers from leaving before the 29th. When about to start, two Eskimos were reported alongside the vessel, and the interpreter of the expedition interrogated them at once. What he had learned was only too plainly told by his face; the terrible truth could not be concealed—Sonntag was dead.

Two days later Hans returned to the schooner; some of his dogs had died and he had been travelling by slow and easy stages. From him the commander obtained a full account of the painful event. According to this statement, the travellers, after having rested at Sorfalik, set out for Northumberland Island, and when they had proceeded about five miles, Sonntag, becoming chilled, left the sledge and ran ahead of the dogs to warm himself. Hans, who halted for a few minutes to disentangle the lines, fell some distance behind, and, while hurrying on to catch up, suddenly noticed Sonntag breaking through the young ice. He hastened to his rescue and helped him out of the water; then he turned back to the snow-hut they had built at their resting-place at Sorfalik. As there was a light wind blowing, Sonntag did not stop to change his wet garments, but ran beside the sledge and thus guarded against danger. But after a while he rode, and when they reached Sorfalik, Hans found his companion stiff and unable to speak. Taking him to the snow-hut, he removed his frozen clothing, placed him in a sleeping-bag, and gave him some brandy. He then closed the doorway of the hut, and lighted the alcohol lamp to prepare some coffee and to warm the room as thoroughly as possible. But his efforts were to no purpose. The second day after reaching the hut, Sonntag died without having uttered a single word.

While the purely geographical results of the expedition had been seriously affected by the ill-favor of the elements, the progress of the scientific labors became greatly impeded by the death of Sonntag, who, as mathematician and astronomer, justified the highest expectations. Fortunately, he had measured a base-line in the vicinity of

the harbor, and had also commenced a trigonometric survey before the long night had set in; he had made a series of valuable pendulum experiments, and had mounted the instruments for the magnetic observations. But, although the work, once commenced, could be continued by Hayes and some of his companions, the results ceased to be of the same high order, for want of the directing spirit.

The sun, which had disappeared behind the hills of the harbor on the 15th of October, remained below the horizon for 130 days; but the winter passed without any grave consequences to the health of the crew. Hayes had obtained a number of strong dogs from the Eskimos, and preparations were being made for a start northward. On the 16th of March he left the harbor with two sledges to examine the condition of the ice, in order to ascertain whether it would finally be better to adhere to the Greenland coast, or to strike directly across the sound and follow the coast of Grinnell Land. To reach Rensselaer Harbor seven full days were required. The cold was so intense that on one occasion the temperature fell to minus 68½ degrees, while the minimum temperature at Port Foulke during the absence of the travellers had been only 27 degrees below zero.

The condition of the ice was very different from what it was in 1853–54. Then the coast-ice was smooth and the range of hummocks only commenced from ten to twenty miles from the shore. Now there was no such smooth track. Evidently the winter had set in while the ice was crowding upon the land; and the pressure seemed to have been tremendous. Numberless hummocks were piled upon old floes; the whole sea was one confused jumble of ice with peaks, spurs, and ridges separated by deep valleys; travelling was laborious in the extreme. Even in Rensselaer Harbor the party found a wilderness of hummocks at places where the ice had been perfectly smooth during the two years of Kane's sojourn.

Despite all difficulties, the journey was continued till Humboldt Glacier came in sight; but the ice grew worse and worse. From the top of a high berg, Hayes had a good view of Cape Agassiz, from which the trend of the great glacier appeared to be more to the eastward than it appears on Kane's chart. At the same times Hayes recognized the necessity of finding a more practicable route along the opposite coast, and, little pleased with his prospects, he returned to his winter-quarters.

The main expedition north had to be delayed on account of low temperatures. After having established a depot of provisions and

baggage at Cairn Point, the explorers left Port Foulke on the evening of the 3d of April. The party, thirteen in number, consisting of every available officer and man, was provided with two sledges, drawn by eight and six dogs respectively. On an additional sledge, drawn by eight men, was mounted a twenty-foot metallic lifeboat, with which Hayes hoped to navigate the Polar Sea.

The men, who had set out on their journey in excellent spirits and full of hope to reach the North Pole, or at least a very high latitude, soon became discouraged by the rapidly-increasing difficulties and obstacles. After several attempts to transport the lifeboat across the sound, it had to be abandoned at Cairn Point on the 7th of April, and the explorers thenceforth depended entirely on their sledges. The character of the route was bad beyond description; ridges of ice, sometimes over a hundred feet high, barred the way and had to be scaled. Unable to find a passage, the explorers often had to resort to pickaxe and shovel to make a track, only to find out at last that they had entered a *cul-de-sac*, necessitating their turning back and seeking for new routes, which seldom proved better. It was more than discouraging, that often, after a hard day's work, they found themselves only a few hundred paces from their last night's camp. In twenty-five days they had barely reached the middle of the sound, and this slow progress was enough to discourage the strongest.

But Hayes was not to be discouraged. He found that, in order to progress, he would have to change his plan of operation. Since he broke camp at Cairn Point he had made, in a direct line from place to place, not over thirty miles, while the number of miles actually travelled, counting all the various twistings and turnings and goings and comings, could scarcely be less than five times that distance. So, in the course of the morning of the 28th of April, he sent the main party back to the schooner, and continued the journey with only three of his most energetic men. These were Jensen, the interpreter, shipped in Greenland, George T. Knorr, the commander's secretary, and John McDonald, a man before the mast. The baggage and stores had been placed on two dog-sledges.

The difficulties and obstacles increased to such an extent that it required fourteen days to travel a distance of only forty miles. Completely exhausted, the explorers reached the coast of Grinnell Land on the 11th of May, and pitched camp under the imposing cliffs of Cape Hawks. It had required thirty-one days to accomplish this distance, which, in a bee line, amounts to only eighty miles. They had been com-

pelled to divide their baggage, in order to carry it on their shoulders over the roughest parts of the route, and to travel several times over the same ground. But now all hardship was forgotten; here was the land, and better times were expected to come. Of the eight hundred pounds of dog food that Hayes had taken with him when he sent back his men, only three hundred pounds were now left, and this could not last more than twelve days. After a hasty meal, the explorers left Cape Hawks, and found the coast-ice, though not very smooth, much more favorable to their progress. Now and then their route led them between the steep cliffs and an ice-barrier of probably fifty feet in height along the ice-foot. Without any serious interruption the journey was continued until the 15th, when Jensen, who had injured one of his legs, became quite helpless. He had to be left behind, and McDonald remained to nurse him.

Accompanied by Knorr only, Hayes continued his march until the 19th, when, according to his statement, he reached latitude 81° 35′ N., longitude 70° 30′ W., where further progress was prevented by thin ice, partly in process of dissolution. An open channel of water extended before him from Lady Franklin Bay to the eastward, and, widening, seemed to join other channels, until it was lost in an open sea. From an elevation of about eight hundred feet above the sea level, the sea had the appearance of "*a mottled sheet of white and dark patches, these latter being either soft, decaying ice or places where the ice had wholly disappeared. These spots were heightened in intensity of shade and multiplied in size as they receded, until the belt of the water-sky blended them all together in one uniform color of dark blue. The old and solid floes* (*some a quarter of a mile, and others miles across*), *and the massive ridges and wastes of hummocked ice which lay piled between them and around their margins, were the only parts of the sea which retained the whiteness and solidity of winter.*" Standing against the dark sky of the north, a noble headland, Cape Union, appeared in dim outline. Hayes judged it to be in latitude 82° 30′ North. Nearer to the explorers, Cape Frederick VII. and, somewhat nearer still, Cape Eugenie were sighted and named. Except the coast on which the explorers stood there was no land visible.

How far these statements and observations are correct we shall learn from the surveys of subsequent expeditions.

Having built a cairn, in which they deposited a brief record of their journey to this, their northernmost point, Hayes and his companion

returned by hurried marches. They found the two men where they had left them on the ice, and, after having lost eight of their dogs, they reached Port Foulke on the 3d of June. Hayes had intended to proceed farther north with his vessel; but a careful inspection of the schooner showed that she would not be able to stand any rough encounters with the ice. He therefore concluded to bear up for the United States, in order to have his vessel repaired, and to return the following year, accompanied by a small steamer, in order to establish a colony at Port Foulke. The observatory, filled with clothing and provisions, was left standing at Port Foulke, and the metallic lifeboat was concealed on Littleton Island.

The schooner left her winter-quarters on the 14th of June, and made a short stop on the coast of Grinnell Land, at Gale Point, about ten miles south of Cape Isabella, to which Hayes proceeded in a whale-boat. The cape itself could not be doubled, but from its summit he noticed that the sound was still full of ice; to attempt anything further with the schooner, therefore, would have been utter folly.

Giving a summary of his experience and the advantages gained for the future, he makes the following statement:

"1. I have brought my party through without sickness, and have thus shown that the Arctic winter of itself breeds neither scurvy nor discontent.

"2. I have shown that men may subsist themselves in Smith Sound independent of support from home.

"3. That a self-sustaining colony may be established at Port Foulke, and be made the basis of an extended exploration.

"4. That the exploration of this entire region is practicable from Port Foulke, having from that starting-point pushed my discoveries much beyond those of my predecessors, without any second party in the field to co-operate with me, and under the most adverse circumstances.

"5. That, with a reasonable degree of certainty, it is shown that, with a strong vessel, Smith Sound may be navigated, and the open sea beyond it.

"6. I have shown that the open sea exists."

His heart swelled by sanguine hopes, Hayes finally left Smith Sound, and after a short stop at Upernivik and Disco, he cast anchor in Boston harbor, on the 23d of October, 1862, after an absence of fifteen months and thirteen days. Unfortunately, his plans were never to be carried out by him in person. The Civil War in which his

country had meanwhile been involved put an untimely end to his explorations. He himself entered the army as surgeon, and the vessel that had so nobly fought against the Arctic ice he offered to the government as a gunboat.

Reviewing the results of the five different expeditions hitherto considered, we can divide the history of the discovery of Smith Sound and its northern extension into three well-defined periods. First, the period comprising the discoveries of Bylot and Baffin; second, the period comprising the discoveries of Inglefield; third, the period represented by the surveys of Kane. These were hardly carried any further by his successor than the discoveries of Bylot and Baffin had been extended by Ross two hundred years after the little Discovery had sighted the mouth of Smith Sound.

From the beginning of the seventeenth century to the return of the expedition under Hayes, adventurers and naval officers, philanthropists and men of science, had more or less faithfully devoted their lives and energies to increase our knowledge of that portion of the Arctic regions.

Fully ten years elapsed before the colors of the United States floated once more from the masts of a discovery-vessel in the Arctic regions. Meanwhile, Charles Francis Hall, born in the State of New Hampshire in 1821, had spent over seven years of his life in searching for the survivors of the Franklin expedition. He was a warm-hearted man, of large muscular frame, and of unbounded enthusiasm in the cause of Arctic exploration. His long sojourn among the Eskimos, following their own mode of life, had fitted him in every respect to withstand the rigors of the Arctic climate, even under the most unfavorable circumstances. Early in March of 1870, one of his friends from Ohio introduced a joint resolution in the House of Representatives to authorize the President of the United States to fit out an expedition towards the North Pole, and to place Hall in command of it. Thirteen days later, on the 25th of the same month, the unanimous consent of the Senate to submit a similar resolution was obtained. This resolution was referred to the Committee on Foreign Affairs, after having been read twice. Finally, on the 11th of June, the bill passed both houses, amended in such a manner that $50,000, instead of double that amount, was appropriated, and it was provided that the vessel should be furnished by the government, and that it should be commanded by any person fitted to lead an

Arctic expedition.* On July 12th, the act was approved by the President.

The Secretary of the Navy subsequently selected the United States steamer Periwinkle, a tug-boat of only 387 tons burden, which was rebuilt at the Washington Navy Yard. Having been newly timbered and her depth increased, her tonnage, when launched on the 25th of April, was about 400 tons. Her name was changed to Polaris. Commanded by Hall, she left New York on the 29th of June, 1871, with a complement of 23 officers and men. Besides the crew, we shall have to mention the Eskimo family, consisting of Joe, Hannah, and child—Hall's former travelling companions. Subsequently two additional officers joined the vessel at Disco, in Greenland, and at Upernivik the Eskimo Hans, with his wife and three children, was taken on board, thus increasing the number of souls to thirty-three.

The Polaris was provisioned and equipped for two and a half years. Her main object was to reach the North Pole, as may be inferred from the following passage, quoted from the instructions, signed by the Secretary of the Navy:

"Having been provisioned and equipped for two and a-half years, you will pursue your explorations for that period; but should the object of the expedition require it, you will continue your explorations for such a further length of time as your supplies may be safely extended. Should, however, the main object of the expedition, viz., attaining the position of the North Pole, be accomplished at an earlier period, you will return to the United States with all convenient dispatch." †

After having left New York, the Polaris touched at New London, where she remained until July 3. Making sail at daybreak, she left that harbor, and, after having passed Rave Rock at 5h. 20m., shaped her course for Newfoundland, reaching St. John's harbor near noon July 11, and remaining there till the 19th. The first port made in Greenland was Fiskernaesset, in latitude 63° 5′ N., longitude 55° 32.5′ W., where the vessel dropped anchor on the afternoon of July 27, and where she remained till daybreak of July 29. Coasting along the steep cliffs, Holsteinburg, in latitude 66° 57′ N., longitude 53°53.7′ W., was reached on July 31, at ten o'clock in the morning. Thence the

* The Statutes at Large and Proclamations of the United States of America, from December, 1869, to March, 1871. Boston, 1871, Vol. XVI., chap. 251, sec. 9, p. 251.

† Narrative, pp. 31, 32.

expedition started again at two o'clock in the afternoon of the 3d of August, arriving twenty hours later at Goodhaven, on the Island of Disco, in latitude 69° 14.7′ N., longitude 53° 34′ W. Here they had to await the arrival of the United States steamer Congress, a supply-vessel dispatched from New York. Having coaled and taken the stores and some sledge-dogs on board, the Polaris left Goodhaven at two o'clock in the afternoon of the 12th, and dropped anchor at Upernivik, in latitude 72° 46′ N., longitude 56° 2′ W., at half-past eleven the following day. She put to sea again at half-past eight in the evening of the 21st, and reached Kingigtok Island at eleven. Here she stopped for two hours to procure some additional dogs, and then made her way to Tassiussak, latitude 73° 21′ N., longitude 56° 5′ W., dropping anchor at half-past five in the morning.

Here Hall tried to secure the services of Mr. Jensen, the trader of the little post, who had accompanied Hayes on his expedition eleven years before. But Jensen could not be persuaded to join the Polaris, being unwilling to leave his family. Although it was perfectly clear and sunny in the harbor, a dense fog outside prevented the vessel from starting before the 24th of August. At fifteen minutes past two in the afternoon the Polaris weighed anchor and steamed out of the harbor, although the fog had not entirely dispersed. Piloted by Jensen, who was assisted by a son of the chief trader of Holsteinburg, she was successfully steered through the somewhat dangerous pass with its numerous islands and sunken rocks. When these gentlemen left, Hall sent his last dispatches. "The prospects of the expedition are fine; the weather clear and exceptionally warm; every preparation has been made to bid farewell to civilization for several years, if need be, to accomplish my purpose." Thus he wrote, full of hope and confidence.

Without having met more ice than an occasional floating berg or some solitary floes, the Polaris found herself in latitude 75° 56′ N., longitude 69° 26.5′ W., at noon the next day. In less than twenty-four hours Melville Bay had been crossed; what most of her predecessors had accomplished by more or less severe struggles, the Polaris achieved without the slightest effort.

At one o'clock in the afternoon Conical Rock was passed at a distance of eleven miles. It forms a steep islet of metamorphic rock, with almost perpendicular cliffs, bearing testimony to the former extent of the coast to the westward. An hour later Cape Dudley Digges was rounded, where, according to the instructions of the Navy Department, Hall was to erect a cairn and to deposit a record.

Ahead of us the sea was perfectly open, and, as even a short stoppage might have proved fatal to the further progress of the expedition, Hall concluded to pursue his course. Towards the north the Petowak Glacier now came in sight, a dazzling ice-stream, reaching the sea. It discharges numerous bergs, of which we counted about sixty in the vicinity of Conical Rock. Between the glacier and Cape Athol the land was almost free from snow.

About six and a half miles to the westward of this cape the cliffs of Wolstenholme Island rise boldly from the sea. If the cape is approached from the south, Saunders Island, situated a short distance to the northward, appears like an elongated high plateau, apparently connecting Wolstenholme Island with the mainland. This illusion, however, lasts only till Cape Athol bears about due east. Then the true character of the surroundings is at once revealed. The entrance to Wolstenholme Sound becomes visible, and on its northern shore we notice a conspicuous peak (Cape Abernethy?) of an altitude of probably 3000 feet, resembling the Matterhorn in Switzerland. Its top appears to be cut off in nearly a horizontal line, and it is surrounded by buttresses with perpendicular fronts, so that it seems as if a low cylinder was crowning the steep cone. Probably the latter is of volcanic origin, while the former seems to consist of metamorphic rock.

Passing between Wolstenholme and Saunders Islands, the entrance of Granville Bay, with the Three Sister Bees in front, was reached towards eight o'clock in the evening. The watch noticed a white streak ahead of the vessel, stretching in an easterly and westerly direction. When reached, it proved to be a seam of half-rotten ice, which could be passed without much difficulty. Through a veil of gray vapor, like dissolving views, the Carey Islands rose in the east, their outlines becoming more distinct, however, after Cape Wechmar was rounded. The distant land to the south had sunk below the horizon, Cape Athol appeared like an island behind Wolstenholme and Saunders Island, which we had passed a short time before.

Towards ten o'clock in the evening the vessel was abreast of Booth Sound, a deep bay with several ramifications; the scenery reminded me vividly of the picturesque shores of King's Bay in West Spitzbergen. The sound was still covered with smooth ice, evidently of one season's growth; the sombre peaks and dark hills bordering its shores were separated by rugged glaciers. The ice extended seaward to the precipitous flanks of Fitz-Clarence Rock, situated near the

middle of the entrance. A few flat "pancakes" drifted slowly in a northerly direction under the influence of the flood-tide. The surface of the sea was perfectly smooth. Only now and then a dovekey, a kittiwake, or a solitary male eider duck was observed. We tried in vain to find an explanation for the scantiness of the avi-fauna. The season was not sufficiently far advanced to cause the birds to leave that part of the Arctic regions, and we did not see any migrating birds, although the open water was very tempting to passing flocks.

At noon of the 27th the Polaris found herself in latitude 77° 51′ N., longitude 73° 44′ W. Up to this time the ice had in no instance interfered with her progress; she had approached the seventy-eighth parallel within a few miles. Towards the north the outlines of Cape Alexander became visible, while in the northwest Cape Isabella rose above the hazy sea, partly hidden by shifting fogs. Towards three o'clock in the afternoon the vessel entered Smith Sound. The look-out in the crow's nest having reported no ice visible, we steamed ahead, with mutual congratulations, at a speed of six or seven knots.

Since the early morning, Hans and his family had been on deck. We now approached the blessed shore where Mrs. Hans had first seen the light; where Augustine and young Tobias, some years before, had roosted in the hood of their mother's jacket, as little Susan was now doing; and where the whole family, with the exception of the broad-faced papa, had made their first acquaintance with soap and water, through the kind offices of Dr. Hayes. Mrs. Hans was greatly excited, but her husband's face had its usual wooden appearance. With the composure of a philosopher he scanned the shore with a spy-glass, looking for men, while little Tobias swallowed an immense chunk of raw beef, happy once more to behold his native land.

On we steamed, catching a glimpse of the head of Port Foulke, the winter-quarters of Hayes, and then passed Littleton Island, which we kept on our right. Near Cape Ohlsen, which rises behind this island, the general trend of the coast suddenly changes from northwest to northeast. As far as Cape Inglefield we steamed in the direction of the land, but now our course assumed a more northerly direction. From a distance we sighted Rensselaer Harbor, where Kane had spent two dreary winters, and shortly afterwards we passed without any difficulty the highest latitude to which his struggling vessel had penetrated eighteen years before. The more the shores of Greenland, veiled by a blue haze, dwindled in the distance, the more distinctly the features of Grinnell Land were revealed, with its grand alpine

scenery, and variously-shaped mountains and peaks, indicating a geological formation different from the metamorphic rocks of the opposite coast.

After having crossed the line of our maximum magnetic declination, which then was 109° W., we met the first real barrier of ice, which seemed to block the sound. This was towards midnight. It was, however, successfully passed, and the vessel reached the open water along the coast of Grinnell Land. At the same time a strong southerly current was noticed. Early in the morning of the 28th a boat landed in a small bight near Cape Frazer, to see whether it could be used as an anchorage in case the vessel should have to turn back. Hall did not consider the place suitable, and in less than a quarter of an hour the Polaris was again under way. Shortly afterwards a dense fog settled on the land, completely hiding the summits of the peaks. Towards ten o'clock it cleared, but only long enough to obtain a few altitudes of the sun. At noon the Polaris found herself in latitude 80° 3′ N., longitude 69° 28′ W.

The coast appeared quite different from the delineation given by Hayes, both with regard to topography and trend. This, in connection with the hazy atmosphere, and the comparatively great speed of the vessel, made it very difficult to identify the various points. In more than one instance we found it impossible to make the chart agree with the outline of the coast as it actually appeared. But under the existing conditions we could not even attempt to make a rough running survey. The main object of the expedition was to reach as high a latitude as possible, and we could not slacken our speed. So we contented ourselves with a panorama of the coast, drawn on a large scale, noting time and bearings, and the distances by two patent logs.

After crossing the seventy-ninth parallel, the Greenland coast could either be discerned only in dim outline, or else was entirely lost to our view. Towards two o'clock in the afternoon we again sighted the shore. The grayish-blue cliffs were partly hidden by opalescent, semi-transparent fog-banks, constantly changing their outlines and positions. The northerly breeze freshened, but the fog, instead of dispersing, only grew more and more dense. About three o'clock the velocity of the wind was 16 miles an hour. With the exception of a calm spell of short duration, on the day when we left Tassiussak, we had experienced only head-winds. A sailing vessel could scarcely have made any progress. Full of high expectations

we steered towards the open Polar Sea, which, according to Kane's statement, we expected to find north of Cape Constitution, and whose existence had been asserted by Hayes. Towards seven in the evening we sighted the cape, looming up through the fog, and in front of it, partially hidden by mists, we noticed Franklin and Crozier Islands, which served as landmarks. Without the islands we could scarcely have identified the place. Before the cape bore east we had already observed that the coast continued to trend in a northerly direction, but how far was impossible to tell on account of the increasing density of the fog. There could, however, be no doubt that we had not to deal with an extensive Polar basin, for we were steaming through a narrow channel, whose shores on both sides were distinctly visible. Cape Constitution had therefore ceased to be the North Cape of Greenland.

Early in the morning of the 29th, at half-past one, the Polaris passed between the coast of Grinnell Land and a small island, situated in latitude 80° 48′ N., which was subsequently named Hans Island. Even at that time it was not difficult to notice that the Greenland shore was still stretching to the north. Towards four o'clock the fog began to disperse, but shortly afterwards it grew so thick that we had to make fast to an ice-floe. About noon it cleared sufficiently to enable us to take a number of altitudes of the sun, which placed us in latitude 81° 21′ N., the approximate longitude being 64° 34′ W. Shortly afterwards we were under steam again, feeling our way through the misty atmosphere. About three o'clock in the afternoon we had the first glimpse of the distant land in the east, but for a short time only. In less than half an hour it was hidden again by dense fog. Towards four o'clock we passed through a narrow band of ice, consisting of fragments of moderate size and high hummocks. Since we had crossed the 80th parallel, only a few bergs had been noticed, but we had seen floes covered with coarse névé, projecting about three or four feet above the water. Now and then we saw the dim outline of the coast, but to get a clear idea of its character was still impossible.

During the night we were surrounded by fog, which gradually grew so dense that at nine o'clock on the morning of the 30th we were once more compelled to make fast to a floe. This floe appeared to be about two or three years old, had a rugged, uneven surface, and was about ten miles long. Some of the hummocks with which it was studded were from ten to twenty feet high, but its main surface was not over four feet above the water. Not a single bird was to be seen.

The only sign of organic life visible consisted in a few small ctenophores, swimming about in a lively manner among the floating masses of ice. The air was saturated with moisture, the rigging was covered with ice, and a dense layer of hoar-frost coated the bulwarks and the masts. During the afternoon it snowed for about three hours, but when it cleared at a quarter-past seven we noticed that the snowfall had not extended over a great area. The southern mountains and hills appeared dark and naked, while the land to the east and west was in its full winter attire. The vessel was unmoored and we steamed slowly ahead. To our right the lofty cliffs of the newly-discovered land came into view, and before us opened a wide bay, subsequently named Newman's Bay, the head of which could not be discerned from the crow's-nest. Never before had the keel of a vessel ploughed the sea which was now being traversed by the Polaris. Towards eight o'clock the ice increased in quantity, but as far as we could judge it consisted only of broken floes and hummocks; not a single berg was to be seen. Some of the fields were discolored by mud. The ice was setting south with increasing rapidity. At 8h. 56m. Hall attempted to land in a small bay. He used one of the whale-boats, but owing to the swiftness of the current he found it impossible to make the shore. Afterwards he tried it again, but with the same result. He therefore named the bight Repulse Harbor.

Following the open leads in various directions, we steamed ahead till half-past eleven, when we were again overtaken by a dense fog, which forced us to make fast to an ice-field. Toward midnight the current reached its maximum velocity of about four knots. The moon was almost full (29d. 18h. 20.8m.); it was probably the time of spring tide, and the velocity of the constant current was evidently increased by the influence of the tidal current. The set was towards the south, but it was impossible then to decide whether the acceleration was due to the flood or to the ebb. As we did not have any fixed point to which to refer the water-level, we attempted in vain to find out whether the tide was rising or falling; moreover, the sounding-gear, stowed in the hold, was not accessible.

At half-past six in the morning of the 31st of August we made a new start, but owing to dense fog the vessel had to be moored again to an ice-field at 7h. 50m. When it cleared, at ten minutes past nine, we continued our northerly course. We noticed more old floes than before; the hummocks increased in number and the open lanes grew narrower.

Budington, the sailing and ice master, whose courage and enthusiasm were not in proportion to his thirty years' experience, declared it impossible to penetrate any farther. He had sung the same song when we first met the ice in Smith Sound, but now he harped somewhat louder and in a higher key, and wished to turn back in search of a harbor. Hall, whose whole ambition was to attain the highest possible latitude, opposed Budington's views, as did every member of the expedition who took an interest in the enterprise.

It is always a disagreeable and thankless task to be compelled to discuss the qualities of a shipmate, and to criticize his actions, but at the same time it is the foremost duty of the historian to be accurate and impartial, even at the risk of touching an exposed nerve. In order to secure the highest degree of impartiality I shall now refer to the published testimony, as given before the Polaris Board, and, furthermore, I shall quote my own opinion expressed at the time, during a consultation held on the bridge of the Polaris, as repeated by Budington himself before the said Board. Budington's statement is as follows:

"Hall held a council with the officers, Dr. Bessels and myself, and the others,—which I have here, that was written down as it occurred, I believe, word for word. It reads as follows: 'Consultation held on board the Polaris in regard to getting further north with the vessel, the vessel being on the east side, looking for a harbor. Dr. Bessels, Mr. Meyers, Captain Tyson, Captain Budington, Mr. Morton, and Mr. Chester. Doctor wanted to cross the straits to look for a harbor, as being better for sledge journeys, while the east side was better for navigation, if we could not get further north. Mr. Morton coincided with Dr. Bessels. Mr. Meyer had the same opinion. Mr. Chester to get as far north as possible. Captain Tyson to get into harbor as soon as possible. Captain Budington to keep on east side as being better for navigation, and certainly better for sledge journeys. It was impossible to get further north on account of the pack. Go along the coast on the east side of the straits northward until a harbor is reached, which could be done in a short time. There had been seen one a few miles south of the present position of the vessel. It was decided by the commander to cross the straits. In doing so we got beset by the pack and drifted back about fifty miles.'"

Budington continues: "That paper was written down at the time, and it was the same in Captain Hall's journal, which unfortunately has been lost. It was left on the ice." When asked by the Secretary of the Navy whether the paper was in his own handwriting,

Budington answered: "No, sir; it was written by my instructions. It is a record of the consultation and opinions given at the time, written down by my instructions by Captain Hall's clerk, perhaps a week after it occurred. The same thing was written down by Mr. Meyers in Captain Hall's journal. Captain Hall once read it to me from his journal and I got the clerk to write down a copy of it, which is this copy."*

Mr. Budington was not an expert in the art of writing; so he had the "copy written down" by Hall's clerk about a week after the consultation had taken place. Why he had our respective statements committed to paper I will leave an open question. The solution of the problem, however, is by no means a difficult one.

It would be an injustice on my part to doubt the correctness of the "copy" unless sustained by the facts; but I feel compelled to state that we did not hug "*the east side, looking for a harbor*," but that it was the intention of the commander, and in accordance with his instructions, and his peremptory duty, to attempt reaching as high a latitude as possible.

As a matter of justice to myself I will also quote a paragraph from the official narrative, published by Rear-Admiral C. H. Davis, U. S. N., which reads as follows: "Dr. Bessels was of the opinion that it would be much better to reach the western coast, where a passage might be found to the north along the land, and where sledge-travelling in the spring would be more practicable."†. That I was not very much mistaken in this opinion may be seen by consulting the results of a passage made by a subsequent expedition, which we shall presently have to consider; and that my statement could not have been influenced by any one on board can easily be inferred from the fact that I was the first person asked by the commander to express an opinion.‡

Mr. H. C. Chester was the first mate on board the Polaris. Let us now turn to those passages of his testimony relative to the movements of the vessel and the condition of the ice. He says: "On the thirty-first day of August, 1871, we got to the highest point we made. The steamer was stopped. We could see through the channel, and there was a water-cloud—a dense water-cloud—to the north. I mean a cloud that denotes open water. I think that we could have gone farther north from that point. It has always been my impression that we might have gone on. It was my watch below at the time. I heard

* Annual Report of the Secretary of the Navy for the year 1873, p. 447.
† Narrative, p. 92. ‡ *Loc. cit.*, p. 92.

them sing out to the man at the mast-head, and heard the man at the mast-head sing out there was a lead close to the land on the east shore, and some one called me. I do not recollect who it was,* but some one called me and said that Captain Hall wanted to see me in the house. I went up, and when I got there the officers were all there and the scientific corps."†

The man at the mast-head, at the time mentioned by Mr. Chester, was Henry Hobby, from whose testimony I shall quote the following passages: "I was on the lookout at that time in the crow's-nest. From what I heard, all the officers wanted to go north. Captain Budington and Captain Tyson said it was necessary to make winter quarters as fast as possible. I could hear every word that was uttered. Captain Budington wanted to go into Newman's Bay; Captain Hall and all the rest wanted to go north, with the exception of Captain Tyson. . . . When I was up there in the crow's-nest, and they were talking about it, I could see a way for going north on the eastern shore, from north to about northeast.‡ So far as I could observe there was open water. . . . There was no ice between us and the open water that I saw. I sung out from the crow's-nest, inquiring where they wanted to go. I told them there was plenty of open water to the northeast. . . . Captain Budington said that we must make winter-quarters. These were just the very words he said. I asked him where he wanted me to go, and he said: 'Right over there, to Newman's Bay.' The ship was lying still at the time, under steam, and not fast; she was just lying there. There was no ice to stop us from going north, as far as I could see. We steamed across towards the west side."§

*It was William Nindemann, subsequently a member of the Jeannette Expedition.

†Report, pp. 480, 481.

‡If the editor of the "Narrative" had studied the various documents of the expedition he would probably not have published the following sentence: "*The belief appears to have been unanimous that it was impossible to advance to the north along the eastern side.*" (Narrative, p. 93.)

When I proposed to the Commander to cross the strait and to follow the west coast, I did so because I considered it then, as I do now, a lack of good judgment and an act of utter folly to shove a vessel blindly into the ice without a coast to fall back upon. In closely following the Siberian shore, Nordenskiold, with comparative ease, accomplished the Northeast Passage, while Weyprecht and Payer actually sacrificed the Tegethoff in consequence of attempting to push through the ice. As another warning example the fate of the Jeannette can fairly be mentioned.

§*Loc. cit.*, p. 556.

Although these statements do not agree in every respect, they still tend to prove that Budington felt reluctant to proceed northward. That those witnesses who testified to having seen a water-sky, frost-smoke, or open water to the northward were correct, may perhaps be proved by the following table, containing some meteorological observations made on board the Polaris during the 30th and 31st of August.

Date.	Time.	Psychrometer.		Relative Humidity.	Wind.			State of Weather.
		Dry Bulb.	Wet Bulb.		Direction.	Velocity in Miles.	Distance in 24 hours.	
1871.	h.			p. c.				
Aug. 30	7	30.8°	29.8°	89.2	N.	12	371.0	Fog.
	4	29.2	28.2	88.8	N.	7		Fog.
	11	31.0	29.0	78.8	N.	7		Fog.
" 31	7	28.8	28.0	91.0	NW.	1	113.0	Fog.
	4	29.2	28.5	92.2	NW.	8		Fog.
	11	28.8	28.0	91.0	0	0		Fog.

Unfortunately, ten observations out of the sixteen made during this period were lost, but the above table speaks for itself. It shows clearly that during six hours of fog the wind was in five instances northerly, and that the air was almost saturated with moisture. That these moist northerly winds, accompanied by fog, which the Polaris experienced while steaming through Smith Sound, must have passed over a sea not entirely covered by ice, can scarcely be doubted.

I am unable to say whether Mr. Budington took these conditions into account, but I state here without any hesitancy that he could not have had more than the most superficial knowledge of the condition and character of the ice at the time. A satisfactory survey of the surroundings can be obtained only from the crow's-nest, but Budington never considered it worth while to ascend the Jacob's ladder. To this, every impartial survivor of the Polaris expedition will testify. According to Budington's judgment it was quite impossible to attain a higher latitude. And Hall, not being a sailor himself, was weak enough to yield to Budington's views. He did this, however, with much reluctance.

About two o'clock on the afternoon of the 31st of August the vessel was headed to the westward to cross the channel, subsequently named by Hall Robeson Channel. The dreary old fog set in anew, and at half-past five we were compelled once more to make fast to a

floe. When the ice opened (at 9h. 25m.) on the morning of September 1st, the vessel was again under way; but at ten o'clock she was moored once more to a floe about five feet above water, and probably not less than five miles in length. During the night an ice-cover, about a quarter of an inch thick, had formed on the narrow leads around the vessel, which now rose and sank under the influence of a gentle swell. A light northerly breeze set the floes and hummocks slowly towards the north, and the northern horizon was hidden by dark frost-smoke.

About two o'clock in the afternoon, Hall and Chester walked across the floe to which the Polaris was moored, attempting to reach the coast of Grinnell Land. They had hardly left when the ice about the vessel began to move, pressing hard against her starboard side and causing her to heel over considerably. The pressure lasted, however, only forty minutes. When Hall and Chester returned, about five o'clock, everything was quiet. They had approached the coast within four miles, and from the summit of a high hummock had noticed a small bay, which, in their opinion, would have afforded a good anchorage. Unfortunately, they had not arranged for signalling the results of their observations, or we might have steamed around the floe to the place. Now it was too late; for Chester, who went to the crow's-nest, reported the leads to have closed.

The ice remained quiet until eight o'clock, when the pressure began again and became much stronger than it had been six hours before. It was evidently due to the turning tide, and the movement of the ice was accelerated by a strong easterly wind. The vessel, anchored to the floe with hawsers fore and aft, suffered a severe nipping; so great was the pressure that the lines bent to the ice-anchors parted under the strain. A large berg bore down upon her, piling up the ice in wild confusion, and at half-past ten it began to hummock under her bow and probably under her keel.

Hall at once gave orders to take stores and provisions on deck. About eleven the force of the pressure diminished, and half an hour past midnight the Polaris was released from the icy grasp of the fields. This peace, however, was only of short duration, and at half-past two we were troubled even more than before. The wind freshened, and a heavy fog set in, entirely concealing the eastern coast, while the shore of Grinnell Land appeared only in dim outline. Shortly afterward it was hidden likewise. Between nine and ten on the morning of the 2d of September the pressure became heavier, and a portion of the stores and provisions was landed on the ice-field on the starboard side of the vessel. Towards 3 P. M. the ice slackened,

and two snow-buntings alighted on the rigging; the meteorological observations, which had been interrupted, were commenced again. At about 4 o'clock on the morning of the 4th, we had the first glimpse of the sun for six days, but its limb was not sufficiently well defined to measure the altitude. Since leaving Tassiussak only four observations for latitude had been obtained, and the last one, taken on the 29th of August, which was not very reliable, had placed us in latitude 81° 20′ N. After the fog had been entirely dispersed, we noticed that we had drifted a considerable distance towards the south. The highest latitude reached was 82° 26′, according to the indication of the patent logs, or 82° 16′, if we make due allowance for the current, the velocity of which, however, could not be accurately determined. Never before had any vessel attained so high a latitude.*

Towards nine in the morning some open leads formed in the vicinity of the vessel, and the provisions were taken back on board. This was accomplished in about three hours; but when the vessel was ready to start we were troubled by dense fog, which delayed her till 8.45 P. M. Steering for the east coast of the newly-discovered channel, the Polaris found herself close to the shore, and Hall started in a boat to look for an anchorage. He landed, and, unfolding the flag, he took possession of the country in the name of God and the President of the United States. Upon his return, the vessel anchored in ten fathoms of water, about 300 yards from the shelving beach. The sun had ceased to be circumpolar, but when we came to anchor it was still perfectly light. Two Arctic fulmars, the winged heralds of open water, came close to the vessel; we had not seen any of these birds since we had left Tassiussak, and a long time elapsed before we saw them again.

After we had breakfasted, Chester went to the crow's-nest and reported water to the northward. Hall consulted with his sailing-master, his first mate, and assistant navigator as to the practicability of getting farther north in the vessel. "*Captain Budington, with an oath, said he would be damned if she should move from there. He*

* The Polaris can probably claim to have reached a higher latitude than lat. 82° 26′ N.; another revision of the day's work results in lat. 82° 29′ N., but positions obtained by dead reckoning cannot lay much claim to accuracy. On a subsequent occasion (June 30th, 1872), Mr. Meyer observed the lower culmination of the sun at Repulse Harbor, which gave lat. 82° 9′ N., but probably the Polaris was more than nine miles to the northward of the small bight when she reached her highest latitude. Latitude 82° 24′, the mean of the three different observations, is probably more accurate.

walked off, and Captain Hall followed him, and they had some conversation together." *

Both Chester and Tyson, who had had a great deal of experience in the ice, tried to convince the commander that a higher latitude could be reached, as may be inferred from their respective testimonies; but Hall, influenced by the sailing-master, gave orders to land the stores and provisions. The honor of the flag, the success of the expedition, were thereby sacrificed to the whim of a single individual, whose moral courage, at his best, was mostly at low ebb.

The anchorage of the Polaris was subsequently named by Hall, Thank God Harbor, and a large iceberg to seaward, which was supposed to protect the vessel from the pressure of the floes, received the high-sounding name of Providence-berg. Without much delay the observatory was erected on the most suitable spot we could find, at an altitude of 34 feet above the sea-level; and Hall, assisted by Bryan and Meyer, commenced to make a survey of the surrounding country, which consisted of a gray, slaty limestone belonging to the upper Silurian, as was shown by the various fossil corals it contained.†

Shortly afterwards, Eskimo Joe, while on one of his hunting expeditions, discovered tracks of musk oxen. His report filled us with pleasure and surprise, for we never expected to find this animal alive in these high latitudes, although some sub-fossil specimens had been discovered by Kane near Van Rennselaer Harbor, and the German Expedition under Koldewey had killed some in East Greenland. Chester and myself, accompanied by the two natives, were sent out on a sledge journey to reconnoitre the interior of the country and to look for this rare game. We left the vessel on the 18th of September, and returned on the 23d with one young female animal, the only specimen seen, although we had noticed numerous tracks. From the top of a mountain about 2000 feet high, subsequently named Mount Chester, we had a good view of the country and could study its topography. We could see the terminus of Newman's Bay and the ice-cap cover-

* Report, p. 299. In the "Narrative" we read on p. 105: "But not relying wholly upon his own judgment and experience in ice-navigation, Hall again consulted, separately, his sailing-master, assistant navigator, and mate, as to the practicability of attempting to get farther north on the vessel. He came to the conclusion that such an attempt would be injudicious."

† In the "Narrative," p. 331, these inoffensive animals are degraded to plants, as may be inferred from the following sentence, which is one of the few in the book touching upon scientific subjects: "*They were the only vegetable fossils that had been discovered by the expedition and were very fine specimens. They looked liked petrified pieces of sugar-cane or bamboo.*"

ing the greater part of the land, with the glaciers discharging in Petermann's Fjord, whose high precipitous cliffs we could trace for a long distance.

After the return of the first sledge-party Hall himself decided to undertake a journey to determine how far north the land on the east side of the channel extended. Accompanied by Chester, Joe, and Hans, he left with two sledges on the afternoon of the 12th of October. The party proceeded overland, and they reached lat. 82° 3′ N., long. 61° 20′ W. There on the high cliffs north of Cape Brevoort, Hall erected a cairn in which he deposited a dispatch addressed to the Secretary of the Navy, stating that "the mountainous land will not admit of our journey further north. * * From Cape Brevoort we can see land extending on the west side of the strait to the north 22° west, and distant about seventy miles, thus making land we discovered as far as latitude 83° 5′ north. There is appearance of land farther north, and extending more easterly than what I have just noted, but a peculiar dark nimbus cloud hanging over what seems may be land prevents my making a full determination."

Shortly after one o'clock in the afternoon of the 24th of October, the party was back on board the Polaris. Hall, who had been exposed to low temperatures, went to the warm cabin without taking off his heavy fur clothing, and drank a cup of hot coffee. Shortly afterwards, he had an attack of apoplexy, to which he succumbed at 3.25 on the morning of the 8th of November, after having shown for several days the most unmistakable signs of serious mental derangement. At eleven on the morning of the 10th he was buried, about a quarter of a mile south of the observatory.

It was not an easy task to reconcile the discoveries made by Kane and Hayes with those of the Polaris, and after Hall had seen from Cape Brevoort that the land on the west side stretched far to the northward, this question became even more complicated.

Kane, as mentioned before, used the observations of Morton to show the existence of an open Polar sea north of Kennedy Channel. Hayes, instead of contradicting the report of his predecessor, not only confirmed it, agreeing to all his views, but also arose as its ardent defender, publishing the narrative of his expedition under the title "*The Open Polar Sea.*" Morton fancied he had seen this open Polar Sea from the northwest coast of Greenland, and Hayes claims to have observed it from the opposite coast, that is, from the east coast of Grinnell Land.

From page 349 of his book I quote the following passage:

"Suffice it here to say that all the evidences showed that I stood upon the shores of the Polar Basin, and that the broad ocean lay at my feet; that the land upon which I stood, culminating in the distant cape before me, was but a point of land projecting far into it, like the Ceverro Vostochnoi Noss of the opposite coast of Siberia; and that the little margin of ice which lined the shore was being steadily worn away; and within a month the whole sea would be free from ice, as I had seen the north water of Baffin Bay, interrupted only by a moving pack drifting to and fro at the will of the winds and currents." Hayes made these observations on the 19th of May, 1861, from a point that he locates in lat. 81° 35′ N., long. 70° 30′ W. He supposed that his radius of vision comprised sixty miles. Why then did he not see from Cape Lieber, the summit of which he claims to have climbed, the opposite coast discovered by the Polaris only a few miles to the eastward?

Whoever attempts to analyze critically the sledge-journey made by Hayes, and tries to compare the results obtained with the astronomical observations taken by Hayes while under way, will be puzzled by many contradictory statements not easily accounted for. His narrative shows that his most northerly camp was established on the 18th of May (p. 348), while, according to the scientific results of the expedition, the position of that very camp was determined astronomically on the day before.*

* *Physical Observations in the Arctic Seas*, by Isaac I. Hayes. Reduced and discussed, at the expense of the Smithsonian Institution, by Ch. A. Schott, Washington City, Smithsonian Institution, 1867, p. 20.

In consideration of the importance of the fact above mentioned, I herewith give the original observation and its reduction, with the resulting latitude.

Farthest Camp, Kennedy Channel.

Observations for latitude of camp, May 17th, 1861.

Meridian altitude of the sun. Dr. I. I. Hayes, observer.

	2 ⊙	
Pocket sextant	56° 52′	Temperature = + 22°.
Index correction	− 1 31	Barometer = 31.0 in. 53°, approximately.
		Approximate longitude, 4h. 35½m.
	55 21	
Altitude	27 40.5	
Refraction—par.	— 1.8	
Semi-diameter	+ 15.8	
Maximum altitude	27 54.5	
δ at apparent noon	19 26.0	
	φ 81 31.5.	

Which of these two statements ought to be accepted? There can be no possible doubt as to the day when Hayes reached his highest latitude. The record that he deposited in the cairn at Cape Lieber is dated May 19th, and this is confirmed on page 351 of the narrative. I quote besides the following passage from the same page, where he states, "We arrived there after a tedious march of 46 days duration." Page 295 shows that the explorers left Port Foulke on the evening of the 3d of April; consequently a march of 46 days would give the date as the 19th of May.

So much for the narrative. But now what do we learn from the astronomical observations? There is no observation on record for position on the 19th of May, but, according to a meridian altitude of the sun, the result of which was latitude 81° 31′ 5″ N., Hayes estimated the position of his most northerly point to be in latitude 81° 35′ N. The next observation for latitude was obtained on the 20th of May,* or the day after Hayes had reached his extreme northerly point. The computation given below locates this in latitude 79° 58.5′ N.

The difference of latitude between Cape Lieber and Camp Leidy amounts to 1° 36.5′. If Hayes could have travelled in a straight line, this day's march would have represented a distance of 96½ nautical miles. But owing to the condition of the ice he could not travel in a straight line, and had to follow the sinuosities of the coast. If we measure his route on Schott's map, accompanying the "*Physical Observations*," we get a distance of 132 nautical miles; and a measurement

* *Loc. cit.* On page 20 we find the following observation:

Camp Leidy, Smith Sound.

Observations for latitude of camp, May 20th, 1861.

Meridian altitude of the sun. Dr. I. I. Hayes, observer.

	$2\,\odot$	
Pocket sextant	61° 14′	Temperature = + 22° (about).
Index correction	— 1 30	Barometer = 29.7 in. at 52°, approximately.
	59 44	Approximate longitude, 4h. 44m.
Altitude	29 52.0	
Refraction—par.	— 1.7	
Semi-diameter	+ 15.8	
Maximum altitude	30 06.1	
δ at apparent noon	20 04.6	
	ϕ 79 58.5.	

on Hayes' own chart (*The Open Polar Sea*, p. 1) would still considerably increase that number. Supposing then that no mistake occurred, Hayes would have travelled at least 132 miles between the 19th and 20th of May.

Page 347 of the narrative contains the following passage: "With the view of ascertaining how far this course was likely to carry us from a direct line, I walked, while the dogs were resting, a few miles along the shore until I could see the head of the bay, distant not less than twenty miles. To make this long détour would occupy at least two, if not three days,—an undertaking not justified by the state of our provisions." To account for this great distance is almost impossible; for Hayes made the above statement on the 18th of May, the day before he reached his extreme northern latitude. The route, therefore, could not have been anything but tempting.

In default of the volume containing the astronomical observations made by Hayes during his sledge expedition, it would be next to impossible to determine the positions of his camps during the second week of May. His narrative throws but little light on this subject, and those paragraphs pretending to give exact statements are in direct contradiction to corresponding passages of the scientific publication.

Hayes unfortunately depended solely upon meridian altitudes of the sun to determine his latitudes, instead of measuring circum-meridian altitudes. If he had adopted the latter method, many of the doubts now resting on an enterprise that cannot but command our highest admiration might be removed. Certain differences could be explained by the supposition that Hayes accepted as meridian altitude an altitude of the sun measured before or after its culmination. In this case, considering the lower altitude of the sun, we would obtain a higher latitude, but at the same time the latitudes determined on the return journey would also be too high.

If any one would study the geography of the Smith Sound region as established by our own observations, and the narratives of Kane and Hayes, without referring to the above-mentioned geographical positions determined by Hayes, the conclusion would be that this explorer, during his sledge expedition, overestimated all the distances, and that he actually did not cross the 80th parallel. A critical comparison of the charts only confirms this supposition. Kennedy Channel is very narrow; it is barely possible to pass through it without seeing both shores. Hayes, however, claims to have seen only the west

coast, though the atmosphere was sufficiently clear for numerous observations for position.

I constructed a chart on a large scale, showing the surveys of Kane and Hayes in different colors. It is not within the compass of this paper to reproduce this chart, but I propose to give a synopsis of the results arrived at with regard to the coast of Grinnell Land north of the 80th parallel.

Hayes deviates but slightly from Kane. He carries the coast-line only a little more to the north, and represents the bays as somewhat deeper than they are represented by his predecessor. Maury Bay, the northern extremity of which Kane located in latitude 80°, Hayes located farther north; and Scoresby Bay received a similar treatment, while the geographical position of Carl Ritter Bay remained unchanged. Hayes marks two small bays between Cape Black and Lady Franklin Bay, not found on Kane's chart; and north of Cape Eugenie, in the same latitude as Kane's Cape Murchison, Hayes located two more bays, hitherto not noticed.

In comparing the chart in Hayes' narrative with that in the *Physical Observations*, it requires considerable study to realize that both represent the same coasts. For the sake of brevity, I will designate the chart in the narrative as No. 1, and that in the *Physical Observations* as No. 2. In No. 1 the mouth of Kennedy Channel is 85 miles wide, almost twice as wide as in No. 2, where it corresponds with Kane's survey, which is the more correct. Although Hayes never sighted the east coast of the channel north of Humboldt Glacier, he made various changes in its representations in chart No. 1, thus producing a perfect caricature of that portion of Greenland. He furthermore shifts the coast-line near Cape Constitution more than 20 miles to the eastward. In No. 1, an island is represented in Carl Ritter Bay, and in Lady Franklin Bay we perceive even two islands not represented in No. 2. In place of the extensive Petermann Bay, in No. 1, we find in No. 2 the insignificant Wrangell Bay, and Wrangell Bay in No. 1 is named Lincoln Bay in No. 2.

I content myself with mentioning only the most apparent mistakes. The discoveries of Hayes and their graphic representation would appear in a still more unfavorable light if we were to base our criticisms upon the facts that the outlines of the coast of Grinnell Land north of the 80th parallel are almost identical on the charts of Kane and Hayes; that Kane's survey of that coast is based solely on cross-bearings taken from the coast of Greenland, and that the coast of Greenland, as

represented by Kane, is located too far to the north. In changing the position of the base-line, those points intersected from various points of the base-line would necessarily also have to be changed in bearing and position. Where Hayes claimed to have seen his "Open Polar Sea," the Polaris had discovered land—land bordering a channel so narrow that the coast of Grinnell Land, even under unfavorable conditions, could easily be seen in the dim light of the moon from the anchorage of the vessel.

The cairn which Hayes states that he erected on Cape Lieber could not be found by the English expedition under Sir George Nares, as we shall see hereafter, and Greely also looked for it in vain. The only discovery Hayes might rightfully claim is that of the United States Sound, the existence of which had already been supposed by Kane.* Mr. Chas. A. Schott, Assistant of the United States Coast Survey, who discussed the physical observations of Kane and Hayes, informed me that Kane on his manuscript chart had actually left the sound open, and that he closed it only after the map had been redrawn and newly projected by Mr. Schott.

After Hall's untimely death, Mr. Budington and the writer held a consultation, according to the following paragraph of the instructions of the Navy Department:

"You will give special written directions to the sailing and ice-master of the expedition, Mr. S. O. Budington, and to the chief of the scientific department, Dr. E. Bessels, that, in case of your death or disability — a contingency we sincerely trust may not arise — they shall consult as to the propriety and manner of carrying into further effect the foregoing instructions, which I here urge must, if possible, be done. The result of their consultations and the reasons therefor must be put in writing and kept as a part of the records of the expedition. In any event, however, Mr. Budington shall, in case of your death or disability, continue as the sailing and ice-master, and control the movements of the vessel; and Dr. Bessels shall in such case continue as chief of the scientific department, directing all sledge-journeys and scientific operations."

The regular scientific observations had been fairly under way; the transit instrument had been set up; and the tide gauge and meteorological observations, which had been made every three hours before entering winter-quarters, were made every hour. Subsequently,

*Kane, Arctic Explorations, vol. I., p. 256.

the pendulum experiments were commenced, and also the magnetic observations.

On the 21st of November, during a heavy northeast gale, accompanied by a blinding snowstorm, the vessel broke out and went adrift. With severe shocks she was repeatedly driven against the floating masses of ice, but after several desperate efforts she came to anchor again, having brought up against the iceberg that Hall had named Providence Berg, and which actually saved her from being carried seaward. After she was again frozen in, a gale from the southwest, which caused great damage at the observatory and at the snow huts containing the magnetic instruments, set the ice once more in motion. The Providence Berg, our only protection, was forced inshore, shoving the vessel before it. If the ice on the lee side had been stronger, the Polaris would have been cut through or thrown on her beam-ends. Afterwards, the berg, which had been split in two, grounded and was at the point of turning over; and when the tide fell still more, the stern of the vessel was some four feet below her bow. Not until the time of high water did she come again on an even keel; but she leaned against the berg with her bow perched upon its tongue, which was under water, and she continued to do so, listing in the most disagreeable manner at low tide. Along the margins of the old floes close by, the hummocks were piled up to the height of about thirty feet, and under the constant pressure the berg began to crumble.

Christmas drew nigh and was duly celebrated, and the new year approached, but the position of the vessel remained almost unchanged. The sea in the channel was open; we could hear the sound of the waves breaking against the ice, and the grinding noise of the floes could not for a moment be mistaken. The propeller and rudder of the vessel were still buried under the piled-up hummocks, and there was great danger that her bow would be wrenched and broken off. Several attempts to free her by blasting proved fruitless.

During the course of the winter the carpenter had made a number of sledges after different patterns, to be used in the spring campaign, provided it should be possible to undertake the proposed sledge-journeys. The increasing twilight now enabled us to obtain a better view of the character and condition of the ice. The sea was covered by high, countless hummocks, with scarcely any level spots between them, and these rugged masses were almost in constant motion. As a rule, the northerly winds produced open water, which

frequently extended to the vicinity of the vessel, while the winds from the opposite direction had a tendency to pack the ice. As the further operations of the expedition were largely dependent on the condition of the ice, the coming changes were closely watched from the top of a neighboring cape. Almost daily the man on the lookout reported open water.

On the 28th of February the sun reappeared after an absence of 132 days; on the same day Joe saw the first dovekies, and on the 14th of March the first snow-bunting was noticed. As we could not reasonably expect to make any progress to the northward in sledges, a small party proceeded to the south to reach Cape Constitution in order to fix its position and to explore the coast. It seemed certain that the remaining work of the expedition would have to be done either by the vessel r by boats. The party, which was subsequently joined by Hans, consisted of Mr. Bryan, Eskimo Joe, and myself; we left the vessel on the 27th of March, and returned on the 7th of April, after having partly explored Petermann's Fjord, and made a survey of the coast. Owing to the ruggedness of the ice and the intervening open water, Cape Constitution could not be reached. Afterwards, several other sledge-journeys of shorter duration were undertaken by Chester, Tyson, Bryan, and Meyer, for the purpose of making surveys and for obtaining game. The deck of the vessel was cleared of ice and snow, and the preparations for the boat-journey to the north were gradually completed.

On the 24th of May the engineers discovered some three feet of water in the bilge; the vessel was leaking; the pumps were tried, but without effect, for they were frozen. Not until the next day was she freed from water, which soon returned with an increase. The leak could not be discovered before the 3d of June. When found, it proved to be on the starboard side of the bow, near the stem, below the 6-foot mark. How badly the stem (which had been cracked) was injured, could not be ascertained, but in the course of the day a corresponding crack was discovered on the port side; and as this side was under water, even at low tide, there was no possibility of stopping the leak. The iron sheathing on the starboard side, which had been removed to caulk the crack and lead it over, was replaced and the pumps had to be constantly worked.

Notwithstanding all these difficulties, two whale-boats with the necessary provisions had been sledged to Cape Lupton, to take advantage of the first opportunity to proceed northward and to try to reach as high a latitude as possible. Chester, in command of one,

had started on the 8th of June, and had lost her on the morning of the 9th, amidst the grinding ice. He returned on board to get the portable Hegelman canvas-boat in readiness to renew his attempt. On the afternoon of the 10th, Tyson, with his crew and myself, left in the George Robeson, following the various open leads, and reached Newman's Bay in the course of the evening, when we were stopped by ice. The boat was hauled up and we camped. The ice to the northward was packed solid and there was no prospect of making any headway. In the course of the evening of the 15th we were joined by Chester, who once more had had a sore time. He had been beset and his boat had drifted to the south, but both he and his crew were in the best of health and full of courage and enterprise. We waited for open water, but our hopes and expectations were in vain. The ice drifted constantly to the south, except occasionally during the time of the spring tides, when a slow motion in the opposite direction could be noticed. Our sleeping-bags, notwithstanding the rubber blankets that formed the flooring of our tents, were saturated with moisture; to keep dry feet was simply impossible; Chester and his crew partook only of one warm meal daily. When the sky was clear, a dark cloud north of Cape Henry could constantly be noticed; this cloud changed its position so little that the tangents we had measured from our camping-place to its eastern and western extremities hardly ever varied by more than a few degrees. The apparent stability of the cloud finally led us to the supposition that it concealed a distant coast, to reach which was one of our most ardent desires. Towards two o'clock on the morning of the 29th, Hans suddenly arrived with a message from Budington, in which he stated that the condition of the vessel was at least a critical one, and that the boat-parties should come on board without delay. Hans was tired out. After he had rested for twelve hours, I accompanied him on board; we proceeded overland and reached the vessel after a march of thirty-nine consecutive hours. We had attempted to make a short cut by following one of the ravines, and finally we were compelled rigidly to follow its course, as it was wholly impossible to climb the perpendicular cliffs. Almost at the same time that I left with Hans, Mr. Meyer started to the northward and, on the 1st of July, reached the shore of Repulse Harbor, where he obtained an observation for latitude. Sorely snowblind, he returned to the camp, without having seen a trace of open water to the northward.

The condition of the Polaris was indeed a critical one; but, neverthe-

less, Budington had attempted twice to penetrate to the northward. In both instances he was stopped by heavy ice. The navigable season had evidently not yet commenced, and more than once the vessel was in danger of being lost. Tyson with the last of his crew returned on the 8th of July, and Chester came back on the 23d, after having made an attempt to return by water; but both boats had to be abandoned.

On the first of August there was sufficient coal left for only six days steaming; the pumps had to be worked constantly, and Budington considered it his imperative duty to start south as soon as an opportunity should offer; but the sea to the north was still blocked. Even during the summer the formation of young ice had seldom ceased. As there was not much chance to make an early start, two of the men obtained permission on the 5th to proceed to Newman's Bay in order to get some of the instruments that had been left there in the boats. They returned early in the morning of the 9th and reported that they had seen high land in the direction where we had constantly noticed the dark cloud from our camp. This land was subsequently named President's Land. While the two men were on the summit of Cape Brevoort, the refraction seems to have been very great; for, Hermann Siemens, one of the two, stated that Cape Union appeared so near that he might have been tempted to throw a stone at it. Shortly after the return of the men, Mr. Meyer, accompanied by one of the sailors, also proceeded to Newman's Bay; but it was misty, and the high cliffs seen by Siemens and Krueger were not visible.

Hans was now sent daily to Cape Lupton to report on the condition of the ice towards the south. On the 12th of August there was considerable open water in that direction and the vessel bore up for home. The observatory had been filled with stores and was well secured. At half-past four in the evening we left the anchorage and steered south, following the various leads. Towards midnight we reached the entrance of Petermann Fjord. From there Cape Union was the most northerly land visible to the westward, and the low shores of Polaris Bay had sunk below the horizon; while an isolated mountain, named by Hall, Inland Island, which in its character and outline vividly reminds one of Heligoland, appeared like an island between Polaris Promontory and the southern mountains. The high land north of Polaris Bay appeared isolated too, when viewed from the deck of the vessel. Meanwhile, the ice was closely packed, but by dint of labor we succeeded in reaching the more open water towards five o'clock on the morning of the 13th. Favored by a good

breeze, we proceeded under steam and sail until we were stopped, at about nine o'clock, by impenetrable pack which compelled us to moor the vessel to one of the floes. The ship, following the motion of the ice, drifted slowly towards the south, and when at about eleven a lead opened, she took advantage of it; but her progress was soon stopped. In the course of an hour we hardly accomplished a mile, and had to anchor once more at a heavy field. On the morning of the 14th several fruitless attempts were made to break through the pack, but about noon a narrow channel opened, which enabled us to get to Franklin Island, which was passed at a distance of three miles. Reaching its southwestern point, we sighted Cape Constitution and the gray cliffs of the John Brown Coast, of massive Silurian limestone. Steaming south, the solid pack was met with again about eleven in the evening; a set of circum-meridian altitudes of the sun placed us in latitude 80° 02′ N. Soon afterwards, the ice closed upon us, but from the crow's-nest some open water to the west and south became visible. Up to noon of the 15th the vessel was in a perfectly helpless position; then we succeeded in advancing a few miles to the westward, but were soon again compelled to make fast to a floe. All our attempts during the 16th to reach the open water were futile; we were fairly beset, and the vessel continued to drift.

As the more important details of the drift are to be considered hereafter, we shall not dwell upon them any longer at present. Towards the latter part of September we were convinced that we should have to winter in the pack, and the necessary preparations were commenced without delay. The leak of the vessel gave more and more trouble, and almost nine hundred pounds of coal were used daily to work the pumps; to stop the leak many plans were devised and tried, but all without the slightest success. A large quantity of stores and provisions were therefore landed on the strongest part of the ice-floe to which the Polaris was secured, and, under the supervision of Tyson, the men began to build a house of old timber and sails to serve as a place of refuge in case of emergency.

The last astronomical observation made to determine the rate of drift of the vessel was obtained on the 12th of October, and placed her in latitude 78° 28′ N.; she was then close to the coast of Greenland; the other data on record are not sufficiently accurate to be considered. It considerably increased our uneasiness that on the 14th of October the vessel began to drift more rapidly to the southwest; in case she drifted out of the sound it was almost a certainty that she

would get in the North Water, where destruction seemed unavoidable. The floe to which she was moored was turning, and at times made a complete revolution. Far to the southeast, Northumberland Island was now in sight, and towards evening a stiff breeze from the same quarter began to blow, steadily increasing in velocity. At 5 o'clock on the morning of the 15th we experienced an unusually heavy snowfall, which lasted three hours. After it had stopped snowing, it blew half a gale, which continued all day, veering through south to southwest, and filling the air with flying snow to such an extent that it was next to impossible to see more than half a ship's length in any direction.

About six in the evening the watch reported that the ice at the stern of the vessel was separating; all hands rushed on deck, and it was discovered that meanwhile open water had formed on the starboard side. She was secured to the floe by an extra hawser over the stern, and preparations were made to abandon her. The massive field which had moved off her starboard side now suddenly came back, exerting such a heavy pressure that the smaller masses of ice were piled up to the height of the rail; a few minutes later she was raised and thrown over on her port side. Under these conditions the floe offered more security than the vessel, which received such a severe nip that her timbers cracked with loud reports and her sides seemed to give way. The night was pitch dark and the snow was drifting before the gale. One of the firemen rushed on deck and reported that the ice had penetrated her sides. The order to land the coal and provisions on the field was carried out with surprising rapidity. Instinctively every one seized what lay nearest to him and placed it on the ice. Most of our valuable collections and the greater part of the records of the expedition were landed. The two remaining boats and the scow had been lowered and carried to the strongest portion of the floe, where the two Eskimo women with their children had taken refuge.

Suddenly the ice-anchors lost their hold, the vessel righted herself and drifted with increasing velocity away from the field. For a few moments the air became clear and the light of the full moon shone on a scene of the wildest confusion and terror. The solid field was split in various directions; we could see portions of the provisions, some afloat and some sinking in the cracks; while many of the crew, rendered desperate by the situation, attempted by jumping to reach larger and safer pieces of ice. Then the moon was hidden again by clouds and we were surrounded by the darkness as before.

The vessel was filling fast, and the little bilge-pump that had been kept going could no longer be made to suck. By burning some of the cabin-doors and parts of the rigging, the engineers succeeded in getting up steam in the little boiler; but the danger that the fire would be extinguished by the rapidly rising water was so great that those on board the vessel did not expect her to float for another hour. The three remaining boats were on the floe, and the masses of ice passing by the vessel during her drift were too small to afford any security. The crew was perfectly helpless, but finally the steam pump gained on the leak, and at daybreak we found ourselves some five miles off the coast near Lifeboat Cove. Chester went to the crow's-nest to look out for the missing nineteen; he examined the ice in the sound with our best spy-glass, but did not see any traces of human beings. It was the opinion of all that our poor comrades had perished during the struggle; but every one feared to express his opinion. There was now nothing left but to run the vessel on shore, which was accomplished with great difficulty. Shortly before noon, when the sun for the last time was visible over the rugged hills, the vessel was beached and secured with heavy hawsers to some grounded hummocks, about 400 yards from the shore. An examination showed that the whole stem below the six-foot mark was broken off, and that the few planks still attached were bent back to the port side.

Preparations were immediately made to land our few remaining stores. The dismantling of the vessel and the building of a house on shore were entrusted to Chester, who, with his versatility of genius, accomplished the task in a remarkably short time. Some of the Itah Eskimos had come to visit us, and they proved valuable assistants. On the 24th of October we were comfortably housed, the engineers let the steam go down, and the wreck rapidly filled.

The scientific observations, which for a time had necessarily been interrupted, were once more taken up, as far as our instrumental means permitted. A small observatory was erected for the transit, and we continued the hourly meteorological observations.

On the 2d of March the sun reappeared, and Chester had already commenced to trim the material for building two boats, which were finished with great difficulty and with the most primitive means on the 17th of May. An attempt of the writer to reach Polaris Bay on dog-sledges was frustrated by the obstinacy and indolence of the native drivers, but another trip to Foulke Fjord, for the purpose of studying the character of the inland ice, was successfully carried out.

Mr. Bryan had been at Van Rensselaer Harbor and at the winter quarters of Hayes to obtain observations for time, and the crew made various hunting expeditions, which, however, did not yield much game. On the 31st of May the meteorological observations were discontinued; our scientific work had now come to a close. The valuable instruments, with a document containing a brief history of the expedition and the plan for our proposed escape, were securely cached in a cairn on the highest point of the peninsula, where Polaris House had been erected.

Early on the morning of the 3d of June the two boats left; one, commanded by Budington, the other, by Chester; only eight pounds of baggage were allowed to each man. Most of the collections saved from the wreck had to be left behind; we carried only our records, one box-chronometer, two sextants, the standard barometer, and thermometers, to verify our observations, and a complete set of meteorological instruments to be used during the voyage, the particulars of which I shall not here mention. The condition of the ice met with during the passage will be told hereafter. It suffices to state that the party, consisting of fourteen persons, was picked up in latitude 75° 38′ N., longitude 65° 35′ W., shortly before midnight of the 23d of June, by the Ravenscraig, a whaler of Kirkcaldy, Scotland, commanded by Captain William Allen, who welcomed us with the warm-heartedness of a true sailor.

Here we learned that our missing companions, Tyson and Meyer, the men, women, and children, had all been picked up near the coast of Labrador in latitude 53° 35′ N. by the Tigress, a sealing vessel from Newfoundland. They had spent 196 days on treacherous ice-floes, living in snow-huts, constantly drifting southward, suffering the pangs of hunger and threatened with a threefold death; but fortunately there was no loss of life. The events of this unparalleled drift of more than 1800 miles are still too fresh in our memory to be dwelt upon.

While we were on board of the Ravenscraig, which was fairly beset in the ice of Melville Bay when her generous captain offered us a passage, a naval expedition, consisting of the ships Tigress and Juniata, commanded by Commanders Greer and Braine, was about to be dispatched by the Navy Department to bring us relief. At Lifeboat Cove the commander of the Tigress found our deserted hut, without discovering, however, the cache with our documents; but he was informed by the Eskimos that we had started south in boats; and then he continued his search in that direction.

After the Ravenscraig had been liberated, she stood over for Lancaster Sound, which she entered early in the morning of the 6th of July. On the 7th, a sail was sighted, and on approach it proved to be the whaler Arctic from Dundee, commanded by William Adams. The Ravenscraig being short of provisions, Mr. Chester, the engineer, four of the men, and myself were transferred on board of the Arctic, where we found Commander A. Markham, R. N., as passenger. We accompanied our gallant skipper on his whaling cruise, which led us in the close vicinity of the magnetic pole, and in steaming out of Lancaster Sound on our way home we picked up four of those of our party who had been left on board of the Ravenscraig. Three others had meanwhile been transferred on board of another whaler. On the 13th of November the last member of the expedition landed safely in New York, and after the Tigress, which had been cruising in search of us till the 16th of October, had also returned to the United States, the whole enterprise had passed into history.

Some of the more important discoveries of the expedition will be mentioned hereafter, and in the course of this discussion we shall also see that those of the crew of the Polaris, who, after the return of the party, made the statement that if Hall had lived through the winter a much higher latitude by sledges might have been reached, were somewhat in error.

While different European nations had been diligently exploring the frozen North, England could not be induced to participate in this noble enterprise. Since the return of the British squadron sent out in search of Franklin and his missing party, nothing whatever had been done by the crown in the cause of Arctic exploration, notwithstanding the various earnest appeals made by scientific corporations, like the Royal Society, and by private individuals.

Encouraged by the success of the Polaris in reaching a high latitude, the Government, in 1875, finally decided to send out an expedition consisting of two vessels under Captain George Nares, the distinguished commander of the Challenger, in order to attempt to reach the North Pole via Smith Sound. The Alert and Discovery, specially built for ice navigation, were selected from the English whaling fleet, and a transport, the Valorous, was ordered to accompany the vessels as far as Disco. Captain Nares was in command of the Alert, while Captain H. F. Stephenson commanded the Discovery; the former, having a complement of sixty-one officers and men, the latter, one of fifty-nine. They

left England in the afternoon of May 29, 1875, and made various stops at some of the Danish settlements to procure the necessary dogs and stores, besides two natives, one of whom was Hans, who had taken part in every exploring expedition to Smith Sound.

The Alert, with the Discovery in tow, finally left Upernivik on the evening of July 22d. After several delays, caused by fog and dangers, the Brown Islands were passed by 4 P. M. on the next day, with a sea perfectly clear of ice before the explorers. A high and steady barometer gave promise that the calm, hitherto experienced after a southeast wind, would probably last for some time. Captain Nares therefore concluded to deviate from the track ordinarily followed by whaling vessels to Cape York and to pass through the "Middle Ice." After a run of sixty miles from the Brown Islands on a west by north course, the pack, consisting of light, open sailing ice, was reached at half-past one on the following morning. The floes were at first not more than 250 yards in diameter, and very much decayed, splitting easily when struck. About 6 A. M., after an additional run of thirty miles through the ice, the latter became closer and heavier, the floes at the same time increasing in size. For fourteen hours, during a run of another sixty miles, the ice showed almost the same appearance; but at 3 P. M. on the 24th, when the channels of water became broader and more numerous, both vessels steered directly for Cape York, which was sighted at 9.30 on the morning of July 25th. One hour and thirty minutes later, about forty-five miles due south of that Cape, the dark "North Water" spread itself before the navigators, who had crossed the much-dreaded "Middle Ice" in but thirty-four hours.

In his official report to the Lords Commissioners of the Admiralty, Sir George Nares expresses the following opinion: "At the latter end of July, with an open season, indicated by the main pack not being met with nearer than fifty miles from the land, in about latitude 73° 20′ and a continuous calm, to allow the northerly running current on the Greenland shore and the southerly running one on the western side of Baffin Bay to open up the ice, I believe a passage can always be made by a steam-vessel; but, unless this favorable combination of circumstances is met with, so far as the scanty knowledge we at present possess enables us to judge, the passage must still be said to be doubtful."

Passages like that of the Alert and Discovery are, however, of rare occurrence; for, even under apparently favorable circumstances,

vessels in the attempt to push through the "Middle Ice" are in danger of getting beset, and of being imprisoned for months, like the Fox, in 1857 and '58, while commanded by Sir Leopold McClintock. On such occasions man is powerless. There is no possibility of saving the vessel, when entrapped in the pack, among floating and grounded icebergs; and an expedition may be wholly crippled even before reaching its basis of operations. If the season is not too far advanced, and if the explorer has sufficient time at his disposal, it will be found safer to follow the land-ice off the Greenland coast, where it is always more or less easy to cut a dock for the vessel, in order to protect her against the pressure of the heavy pack.

This course had been taken four years before by the Polaris, under the most enviable natural conditions; and, owing to the almost total absence of ice, she accomplished the transit of Melville Bay between the 24th and 25th of August in twenty hours and forty-five minutes from Tassiussak, while the Alert and Discovery needed seventy hours to make Cape York from the time of leaving Upernivik.

Near Cape York the Discovery on July 25 headed for the shore to communicate with the natives, while the Alert proceeded towards the Cary Islands, where she was to be rejoined by her consort. Many icebergs, partly aground, were met with off the Cape, arranged in lines that followed the trend of the coast towards Conical Rock and Cape Athol. The bergs, of which a great number had also been observed by the Polaris at the same locality, were less numerous in the offing, and Sir George feels inclined to attribute this fact to the existence of a southerly current, which he experienced the following day while on his passage to the Cary Islands. This group was reached by the Alert early in the morning of the 27th, where a depot of provisions to maintain sixty men for two months was placed on the north-easternmost island of the group. It was high water about 5 A. M. of the 27th. From midnight until 2 A. M. the set of the current was to the northward; at 3 A. M. it was setting towards the northeast, and from 4 to 6 A. M., when both vessels left, the set was southerly. Steaming to the eastward, meeting hardly any ice, except a few scattered bergs, they anchored at Port Foulke early on the morning of the 28th. Before the expedition left England, I wrote to Commander Markham to have a party landed at our old winter-quarters at Lifeboat Cove, and to search the cache we had made there, which the Tigress, strange to say, had failed to discover, and to take our pendulum on board and have it swung in connection with that which

the members of the expedition were about to use. While Captain Stephenson explored the head of Foulke Fjord, Sir George, in company with Markham, proceeded to the spot. "The cache was readily discovered, but contained nothing." It had evidently been pilfered by the natives shortly after we had left Polaris House, although none of the objects it contained could have been of the least service to the Eskimos. The party found, however, three skin boats, left on the shore and weighed down with stones, the smallest of which was afterwards taken for conveyance to Cape Sabine. As the Itah natives do not use any boats at the present time, I think it highly probable that these Umiaks belonged to some of the western Eskimos, then visiting the Itanese; an incident of rare occurrence.

The morning of the 29th found the Alert and her consort sailing across the sound for Cape Isabella, with a northerly wind and fine weather, which was followed by a blinding snowstorm when they reached the coast. On the outer spur of the granitic walls of the cape, 700 feet above sea-level, the explorers built a cairn, and at a lower elevation they deposited about 150 pounds of preserved beef and an empty cask, intended for the reception of any letters that might be brought by a vessel the next year. At 5 P. M., the wind having died away, they steamed to the northward for Cape Sabine. Scarcely twenty-four hours before, when viewed from the summit of Littleton Island, the sea seemed to be entirely free of ice; but now, about fifteen miles north of Cape Isabella, the battle with the pack already began. The ice consisted of large floes and broken fields; it surrounded the vessels, and extended as far north as could be seen from the crow's-nest. "From this date the progress was one endless and unceasing struggle with the ice; ever on the watch and never allowing a favorable opportunity to pass unheeded." In a little harbor, subsequently named Payer Harbor, the vessels were detained for three days, watching for an opening in the ice. On the southernmost of the neighboring islets a depot of 240 rations was made, and on the summit of the outer one the expedition left a cairn with a notice of their movements. The pack in the offing consisted of floes from five to six feet thick, occasionally intermixed with heavier floes, but all much decayed and honeycombed. After several hours of light westerly winds, the vessels were at last enabled to round Cape Sabine on the morning of the 4th of August. Bearing away to the westward, they steered up Hayes Sound, keeping close to the land, the grounded icebergs giving timely notice of shoal water. Very

heavy ice was piled some thirty feet high against the northern point of Cape Sabine. About noon the vessels opened a land-locked bay, named Alexander Harbor, and as the ice ahead was closely packed, they steered for the entrance and cast anchor. On the 5th of August, the strong tides, combined with a southwesterly wind, opened a channel to the northwest, and thereby a few miles were gained; but afterwards the vessels were helplessly beset. Twenty-four hours later they bored their way through the slackening ice and emerged into a space of open water.

The surveyors of the expedition soon discovered that the map of the west coast of the channel as drawn by Hayes was greatly in error. The two islands marked by him in the entrance of the sound bearing his name were found to be joined, as originally represented by Inglefield, and no inlet between Cape Camperdown and Cape Albert could be seen. The party of the Polaris wintering at Life-boat Cove had been informed by the Itah natives that Hayes Sound opened to the westward into a broad expanse of water, and they fully believed that statement, for the Eskimos are excellent topographers. Captain Nares is, however, of the opinion that it is landlocked, for the flood-tide came from the eastward, and the ebb or east-running tidal current was stronger than during the flood. On two occasions, however, the ice in the offing was setting to the eastward with the flood tide. The future will have to decide whether Ellesmere Land is separated from Grinnell Land or not.

After various narrow escapes, and after overcoming great and unexpected obstacles, the vessels on the 9th tried to round Cape Prescott, but had to make fast to a floe; Franklin Bay was still covered with smooth ice of one season's growth. During the two following days the weather was calm, with fog and light rain. From the summit of Lockyer Island, about 900 feet high, some open water could be discerned near Cape Victoria; but in the offing and in a northeasterly direction towards Cape Hawks the ice was closely packed. In the afternoon of the 12th it at last began to move slightly to the eastward, and the vessels made a new start, and at nine in the evening passed the imposing cliffs of Cape Hawks, where a boat was landed and a depot made similar to that left on the Cary group. On this occasion a party visited Washington Irving Island to erect a cairn, and were surprised to find the remains of an extremely old one. The stones were covered with lichens, and the structure could certainly not be attributed to Hayes. Again the vessels were greatly troubled by

ice, and blasting and cutting were necessary in order to form a dock; but on the 19th of August they were able to proceed, after having advanced not more than about ninety miles in three weeks. Cape Frazer was successfully rounded in the course of the evening, and Captain Nares could confirm that the northern and southern tidal waves actually meet within a few miles from the region which I had pointed out.* From the summit of Cape Barrow, leads of open water could be distinguished to the northward, partly covered by loose ice; and near Cape Constitution the sea was probably as open as at the time when Morton discovered his "Open Polar Sea." Early on the morning of the 20th of August, when the ice had slackened, the vessels left their moorings at the height of spring-tide. The commander was well aware that during the present tides this would be his last chance to proceed, without the help of strong westerly winds; he therefore bored his way through the pack for two miles. Cape Norton Shaw was rounded without difficulty, and Scoresby Bay was opened; but off Cape McClintock, while the vessels passed through a channel between two closing floes, they were badly jammed and barely escaped a severe nip. They succeeded, however, in reaching Cape Collinson, but then they were once more obliged to make fast to a floe, for the open water previously seen to the northward had

*Markham states on page 106 of "*The Great Frozen Sea*," that they "were able to confirm the observations made by Dr. Bessels of the Polaris relative to the meeting of two tides at or about this point. This fact materially strengthens the argument in favor of the insularity of Greenland, for it has been deduced from a series of tidal observations obtained by us, that the tide to the northward of Cape Frazer—that is, the tide in Kennedy and Robeson Channels—is undoubtedly the same as the North Atlantic one, and therefore flows along the northern coast of Greenland." My friend Markham, when he wrote this passage (and also Captain Nares), was evidently not aware that I had proved the insularity of Greenland by means of our own observations, long before the English expedition returned. A copy of the paper, published at Washington, on the 29th of February, 1876, was sent them to London, and taken with the rest of the mail to Smith Sound by Sir Allen Young, in the Pandora. The accompanying map, with the co-tidal lines, which is reprinted in Vol. I. of the Scientific Results, proves that I traced the course of the tidal wave around the north coast of Greenland to Polaris Bay. During our daily intercourse, while on board the Arctic, we conversed freely upon the subject, but I then considered the tidal wave of Polaris Bay to be of Pacific origin. When the results of the German expedition to East Greenland were published, and when I had consulted the literature on the subject, I was at once convinced of my error, and so stated without hesitation.

disappeared. Two hundred and forty rations were landed near the Cape; while this work was in progress, the current was observed to set more rapidly to the southward than had been previously noticed in the wider parts of the sound. Markham estimated its velocity at one and a half or two knots;* Sir George Nares states that during each flood-tide about five miles of ice drifted south, while during the four hours of the ebb it remained almost stationary. On the north side of each point of this shore the hummocks were piled up to a height of from 20 to 30 feet, but elsewhere hardly any signs of great pressure could be noticed.† After two futile attempts to push to the northward along the west coast, the commander finally decided to stand to the eastward. Several miles of closely packed ice had to be broken through before they reached the middle of the channel, where they found some open water; but then the wind commenced blowing so hard from the north that the vessels had to be worked to windward under fore-and-aft-sails, and the floes made short boards necessary. Notwithstanding all difficulties, they made good headway; but, on reaching Cape Morton on the morning of the 23d, they found a solid barrier of large fields and immense hummocks, stretching across Hall's Basin to the westward, and as far to the north as the eye could reach. While the Discovery landed two hundred and forty rations at Cape Morton, the Alert was taken to Bessels Bay, where in the evening she was joined by her consort. From the summit of Hannah Island it could be noticed that the loose ice met with in the channel was now drifting rapidly to the north before a strong southerly wind; this was not at all encouraging, for, the heavy pack blocking Hall's Basin was thereby constantly increased. It was low water at Bessels Bay at 10.40 P. M.; the ebb current had ceased to run 40 minutes before, and at 11 P. M. the flood current was setting in the bay with sufficient force to swing the ships broadside to the wind. Early on the morning of the 24th Captain Nares discovered from the summit of Cape Morton a lead to the westward, which was speedily followed, and after severe struggles with the ice at Cape Lieber, the explorers reached the north shore of Lady Franklin Bay, and were there greeted by a herd of nine startled musk oxen. The commander wisely decided to leave the Discovery in a snug little harbor, subsequently named after their vessel, and to proceed north in the Alert; the navigable season was rapidly drawing

* *The Great Frozen Sea*, p. 108.

† *Nature*, 1876, p. 29.

to a close, and after an excellent harbor had once been secured in a high latitude the success of the expedition seemed certain, even if the advance vessel should meet with an accident. Better measures could hardly have been taken; the retreat of the party, in case of emergency, was well covered by the various depots established on their way north and by the vessel about to be left at Discovery Harbor. To strengthen the force of the Alert and to keep up communication with her consort, one officer and seven of her men joined the advance vessel, which left Discovery Harbor on the morning of the 26th of August. Meanwhile the pack had set in, and the ship, trying to keep clear of the moving masses of ice, touched ground and hung for a short while. By lightening her, and lowering her boats, she was soon afloat again without having been damaged. In the course of the afternoon, a narrow lead opening, the vessel was able to proceed; but at Distant Cape the solid pack was met once more, stretching apparently across the strait, and the Alert came to a stop. During the following day a light northeast wind caused the ice constantly to move to the south, except during the time of the ebb-tide, when it either remained stationary or set slowly in a northerly direction, but not with sufficient velocity to open a passage. On the 28th the explorers succeeded in advancing fifteen miles, but in attempting to push through the pack, the rudder-head, which had already been badly sprung, became so much injured that the rudder was almost useless, and the vessel was secured to some grounded ice in a small bay to repair damages. Cape Beechy was easily rounded on the following day, but the vessel had a narrow escape afterwards in doubling Cape Henry VII. The ice had now assumed a wholly different character; some of the grounded masses were estimated to have a thickness of from eighty to one hundred feet. They were not of glacial origin, but had evidently been formed on the sea; still they looked like formidable icebergs; they combined the character of actual floes and real bergs, and were therefore named floe-bergs. After a depot of one thousand rations for spring travelling had been landed on the north side of Lincoln Bay, which had been reached on the 29th, the Alert, at time of high water on the following day, was enabled to proceed to the northward. A night of anxiety was spent in the moving pack, for the vessel had hardly entered a promising lane when she was enclosed by the ice; but she succeeded in struggling back to Lincoln Bay. On the morning of the 1st of September the ice opened along the mainland, and the commander, attempting to do his utmost,

ran to the northward before a strong gale, and about noon reached latitude 82° 24′ N., the highest latitude ever attained by any vessel. The ship had been running at the rate of at least nine knots; she tried to reach President's Land, reported by the Polaris, but near one o'clock she was suddenly stopped by an impenetrable pack. Finding that the ebb-tide was setting towards the northwest along the land, and that the ice moved towards the shore, the Alert, which meanwhile had been moored to some grounded pack near Cape Sheridan, was taken to a more secure place. There, in latitude 82° 25′ N., longitude 61° 30′ W., she was compelled to winter. Markham and Lieut. Pelham Aldrich had been sent out to examine a bay about eight miles to the westward, which promised to be a good harbor; but it was unapproachable on account of stranded ice. The anchorage of the Alert was fully as unsafe as that of the Polaris; her only protection consisted in a number of floe-bergs grounded at a distance of a couple of hundred yards from the shore, and more than once she was seriously imperilled. Fortunately, she experienced only one of those heavy northeast winds, which, as a rule during the winter months, form the greater percentage of winds in these high latitudes, and the rise and fall of the tide was very slight, amounting to not more than about 36 inches, even at time of spring-tide.

After the newly-formed ice was strong enough, the provisions and stores were dragged on shore, and several small sledge-parties and a boat were sent out to reconnoitre the coast and to establish a depot. The coast was found not to extend as far north as stated by the Polaris; and the land reported by two of the Polaris' crew as named President's Land could not be seen. "The sky being [illegible] clear," Captain Nares says, "this was the first day on which we were able to pronounce decidedly concerning the northern land reported to exist by the Polaris. After a constant watch and carefully noting the movements of the darkened patches, I was now with much reluctance forced to admit that no land existed to the northward for a very considerable distance. As seen through the light haze, the dark reflection of the sky above the detached pools of water in the offing, in strong contrast by the side of the light reflected from the close ice, which in a great measure is similar to the bright glare reflected from a large sand flat, creates a very decided appearance of land where there is a mirage; indeed sufficiently so as to deceive many of us when so anxiously expecting and hoping to see it."*

Nature, 1876, p. 33.

On page 383 I have stated the conditions under which this land was sighted. It was seen only by Hermann Siemens and Robert Krueger, two of our most trustworthy and experienced seamen; when Mr. Meyer proceeded to Newman's Bay a few days later, it was not visible, but he noticed the same dark land-cloud which I have described, and which apparently had not changed its position. The only explanation I can offer is that the men applied the variation of the compass in the wrong direction, and that the land they sighted is actually a portion of the high northern coast of Greenland; for, they told me at the time of their return that the distant land was so plain in view that they could discern its deep ravines and the various snow-patches covering the mountains. Unfortunately the surveys of the expedition were lost on the ice, and the chart drawn after the return of the party could therefore be only an approximation. Although this chart was published by the United States Hydrographic Office, this office can not be held responsible for its shortcomings; for, the details of the west coast—the work of the Secretary of the Navy and his friends—were put in at his own private office at the Navy Department, to the great disgust of the late Rear-Admiral Wyman, who at that time was the Hydrographer of the Navy. In consulting the brief diary of current events, which I am in the habit of keeping, I find how bitterly he complained one morning "to have to put such stuff on the chart." He was then coming from the old Navy Department, holding a proof of the chart rolled up in his hand. A comparison of the Polaris chart with the chart published by the Admiralty will easily convince us that the Army Fjord of the American chart can only be meant to represent the bay between Cape Sheridan and Cape Joseph Henry. Every member of the expedition was convinced at the time that the delineation of the coast of Grinnell Land as given by Hayes was utterly erroneous, but owing to the loss of our material we were not justified in making any alterations, although most of us were positive that Hayes could not have been north of the 80th parallel. To satisfy our doubts we longed to cross to Lady Franklin Bay to examine the cairn which Hayes claimed to have erected on Cape Lieber; but, the ice being in constant motion, we were unable to do so. The English expedition did not find it, and, as we shall subsequently see, Greely and his party also looked for it in vain. If there, it could not have escaped detection, even though partly demolished, for the traces of a cairn are not easily obliterated.

We shall now return to the Alert, whose commander, on the 25th

of September, sent Markham on a sledge journey to the north to establish a depot of provisions as far in advance to the northwestward as possible. Markham had three sledges, two of which were respectively commanded by Lieutenants Parr and May. Four days before his leaving the vessel, Lieutenant Aldrich had started with dog-sledges, provisioned for four days, to pioneer the road around Cape Joseph Henry for the main party. He returned on the 5th of October, after an absence of thirteen days. From the summit of a mountain about 2000 feet high, in latitude 82° 48′ N., he could trace the coast-line for a distance of sixty miles to the northwestward to latitude 83° 7′ N. Markham returned on the 14th, having succeeded in establishing his depot in latitude 82° 44′ N., and in sighting land nearly two miles further north. He had thereby surpassed the latitude reached by Parry forty-eight years ago, the highest latitude theretofore attained. Another party, sent out under Lieutenant Rawson on the 2d, to communicate with the Discovery, returned after an absence of ten days, without having accomplished its object. The ice was simply impassable.

On the 11th of October the sun had departed, and by the 26th the ship was completely housed in. On shore, the magnetic and other observatories were erected, and soon afterwards the officers in charge of the different scientific departments were hard at work. A school for the benefit of the crew was established; there were weekly theatricals, and the commander and his officers delivered weekly lectures on various topics that might be of interest or use to the men.

When the year 1875 drew to a close, diligent preparations were made for the sledging campaign to take place during the forthcoming spring. Contrary to the experience of the Polaris, the ice in the channel became stationary towards the middle of November; the last pools of open water seen off Cape Rawson disappeared towards the 20th, and no movement in the ice occurred during the winter. Merely a few tidal cracks outside the grounded floe-bergs could be noticed, and their width seldom exceeded a couple of feet, and this only at the time of spring tides.

The last bird seen, before darkness set in, was a snowy owl; this was on the 2d of October. Animal life was scarce, "a few eider ducks, a family party of longtailed ducks, a few turnstones, a single dovekey and a hare,"* were the only vertebrates seen near

* Feilden, *Notes from an Arctic Journal*, p. 44.

Floeberg Beach in 1875, if we except some specimens of charr, a small land-locked salmon. During the sledge-journeys made in the course of autumn, Markham came across four ptarmigan; a snow bunting was noticed in latitude 82° 35′ N., on the 14th of September, and the tracks of foxes, lemmings, and ermines were discovered, but not the animals themselves. In latitude 82° 33′ N., Feilden found the skeleton of a musk-ox.

On March 1 the sun returned after an absence of one hundred and forty-two days. Captain Nares, desirous of communicating with the Discovery, after the futile attempt made during the previous autumn, dispatched on the 12th Mr. Le Clere Egerton in charge of a dog-sledge. He was accompanied by Lieutenant Rawson, the officer of the Discovery who had left his vessel when the two ships parted company; the third member of the travelling party was Christian Petersen, the interpreter, who in the same capacity had shared the fortunes of Kane. On the second day out Petersen was taken sick. The party pitched tent, and while busy in preparing supper and attending the dogs, the two officers sent Petersen inside to shift his foot-gear and to get into his sleeping-bag. He neglected, however, to change his stockings, and had his feet severely frost-bitten, and his face and hands had suffered likewise. As it was impossible to keep him warm, they made a burrow in a snow-bank, and, carrying him thither, they tried to warm him by the heat of their own bodies. The condition of the patient became so critical that he had to be taken back to the vessel. Subsequently, both of his feet were amputated, and about two months later he succumbed to his sufferings. Egerton and Rawson, who had also been severely frost-bitten, renewed their attempt on the 20th of March, accompanied by two seamen; fully six days were, however, occupied in accomplishing the short distance that lay between the two vessels.

On April 3, fifty-three officers and men—all in the most perfect health—left Floeberg Beach with seven sledges. Markham, seconded by Lieutenant Parr, with two boats equipped for an absence of seventy days, was to force his way to the northward on the ice, to reach as high a latitude as possible. They were accompanied by three sledge-crews, who were to follow them as long as the state of their provisions would permit. Lieutenant Aldrich, assisted by a crew under Lieutenant Gifford, had orders to explore the shores of Grant Land towards the north and west.

On the 10th of April, Rawson and Egerton, who had returned from their trip to the Discovery the day after the seven sledges had left, started with a light sledge to mark a convenient road across Robeson Channel for the sledges of the Discovery, which were to explore the north coast of Greenland under Lieutenant Beaumont. Accompanied by Rawson, who had meanwhile picked a road, and by Dr. Coppinger, Beaumont left on the 20th of April. Three days later, Captain Stephenson arrived at Floeberg Beach from Discovery Harbor, and the two commanders consulted as to further steps to be taken. The crew of the Discovery had been well during the whole winter, and the temperature experienced had been almost as low as that registered by the Alert. Early in March the minimum temperature at Discovery Bay was 70.5°, and that at Floeberg Beach even 73.7° below zero. "The Alert's minimum temperature for twenty-four hours," according to Captain Nares, "was 70.31° below zero, the Discovery's minimum temperature for twenty-four hours was 67.0° below zero. The Discovery experienced a mean temperature for seven consecutive days of 58.17° ditto. The Alert experienced a mean temperature for thirteen days of 58.9° ditto; and for five days and nine hours of 66.29°. During February, mercury remained frozen for fifteen consecutive days; a southwesterly gale, lasting four days, then brought warmer weather; immediately the wind fell, cold weather returned, and the mercury remained frozen for a further period of fifteen days."*

Until the latter part of May, sledge-parties were constantly coming and going to keep up communications and to establish depots of provisions. Lieutenant Archer had explored Lady Franklin Bay, and found it to be a large fjord of some sixty miles in length, with valleys filled by glaciers; while Lieutenant Fulford and Dr. Coppinger had been examining Petermann Fjord.

On the morning of June 3, Lieutenant Parr arrived at Floeberg Beach with the distressing intelligence that Markham's party was suffering from scurvy. They had reached latitude 83° 20′ 26″ N., the highest latitude ever attained; they had struggled against natural obstacles unparalleled in the history of Arctic exploration, and had returned to Cape Joseph Henry. Captain Nares at once organized a relief-party headed by himself, which left towards midnight. Although Lieutenant May and Dr. Moss, in company with a seaman, made a forced march, they were too late to save the life of George Porter, Gunner, R. M. A., who had expired a few hours previous to their arrival.

* *Nature*, 1876, p. 35.

When the broken-down party arrived at the ship, early in the morning of the 14th, only five of the seventeen original members of the crew were able to drag the sledges alongside; the rest had to be carried. Markham had been absent for 72 days; his outward track extended to a distance of 319 miles, and his track home, to 281 miles, making a total of 600 miles (statute). A sounding taken at the northernmost point reached gave 72 fathoms with clay bottom; the temperature at the bottom was 28.8°, and that of the surface of the sea was only 0.3° less, while the temperature of the air was only 8° Fahrenheit. He had reached his highest latitude on the 12th of May, in longitude 63° 5′ W., as measured on his track-chart. The road had been difficult beyond description; a great deal of their way had to be forced by means of the pickaxe and shovel. The surfaces of the fields "were thickly studded with rounded, blue-topped ice-humps of a mean height above the general level of from 10 to 20 feet, lying sometimes in ranges, but more frequently separated at a distance from 100 to 200 yards apart; the depressions between being filled with snow deeply scored into ridges by the wind, the whole composition being well comparable to a suddenly frozen sea. Separating these floes, as it were by a broadened-out hedge, lay a vast collection of *débris* of the previous summers; broken-up pack-ice, which had been refrozen during the winter into one chaotic, rugged mass of angular blocks, of various heights up to 40 and 50 feet, and every possible shape, leaving little if any choice of a road over, through, or round about them." *

Similar conditions of the ice were noticed by the eastern and western divisions, commanded respectively by Lieutenants Beaumont and Aldrich. The former explored the north coast of Greenland to latitude 82° 18′ N., longitude 50° 40′ W.; the northeasternmost point sighted by him is probably situated in latitude 82° 54′ N., longitude 48° 33′ W. His party was also attacked by scurvy, and he had to deplore the loss of two men. After an absence of 120 days they arrived at Discovery Harbor on the 14th of August, and after an absence of 84 days Aldrich reached his ship on the 25th of June. The whole party suffered from scurvy; only the commander and two men were able to walk to the side of the vessel. He had traced the northern shore of Grinnell Land to about longitude 87° W., and had surveyed not less than two hundred and twenty miles of new coast-line.

The breaking out of the scurvy, and the insurmountable obstacles

* *Nature*, 1876, p. 40.

encountered by Markham during his journey over the pack, having fully demonstrated the futility of renewing the effort in the following year, Captain Nares announced his intention to abandon all further exploration in a northerly direction, and to proceed southward as soon as the ice should open. But to liberate the Alert was not an easy matter. A large number of torpedoes containing from 1 to 50 pounds of powder were used to clear a passage in order to effect an escape; the attempt proved successful on the morning of the 31st of July. A fresh south-westerly wind had blown the ice off-shore and cleared a channel to the southward. Soon afterwards, Cape Joseph Henry was lost to sight, but at Cape Union very heavy floes interfered with the progress of the vessel and detained her until the next day. The passage of Robeson Channel was extremely perilous; it was only by a combination of consummate skill, audacity, and good luck that it was finally effected. On the third day of August, the Alert was hemmed in by ice and was nearly pushed ashore at the same place where, on the 29th of the same month of the preceding year, her damaged rudder was stripped; here she was detained for eight days. When liberated, on the 11th, she gained Discovery Harbor in the course of the evening, and the two ships' companies were once more together. But Lieutenant Beaumont and his party were at Polaris Bay, and Captain Nares therefore decided to force the Alert across the channel in order to take the travellers on board. About noon of the 14th, Beaumont's party was discerned on the moving pack off Discovery Harbor, and early the next morning every surviving member of the division was on board. The two vessels were delayed until the 20th, when they pushed their way through the formidable floes and rounded Cape Lieber; but on nearing Cape Lawrence the ice became so close that they had to be secured to some of the floe-bergs grounded in the vicinity, and could not proceed until the 22d. Reaching Cape Collinson, the two vessels fouled for a few moments, but the whole damage done was the loss of a davit; the boat itself was saved. The first real icebergs met with in proceeding south were found in Rawlings Bay. After having been driven back twice to Maury Bay, the Alert and her consort successfully rounded Cape Frazer on the 24th, and on the 27th reached Dobbin Bay, where they were detained till the 3d of September.

Meanwhile, Sir Allen Young, who had left England on the Pandora, had reached the mouth of Smith Sound, wishing to land dispatches and letters at the depot near Cape Isabella. On the 3d of

August he was at Littleton Island. Twelve days later, he attained his highest latitude, viz., 78.45° N., in longitude 73° W., and found the sound filled with solid pack, stretching from shore to shore. He crossed and recrossed the sound looking out for any boat-party that might have been dispatched by the English exploring vessels; all this time he had to keep his ship constantly in motion to prevent her from being beset. During the first week of August, the winds were invariably blowing from the northward, and large unbroken floes came down the sound. One with six icebergs imbedded in it was of so great extent that it seemed to fill the strait from shore to shore. The outer or eastern edge of the pack always presented one unbroken curve from the direction of Cape Dunsterville, in the southwest, round to Cairn Point or Littleton Island, leaving a land water in Hartstene Bay. On the 27th, the Pandora was driven out of Smith Sound by a raging gale, while the two discovery ships had just reached Dobbin Bay, where they were detained until the 3d of September. The temperature had fallen to 19°; the young ice formed rapidly, and was so thick and tough that it was difficult to pass through it in a boat. On the 9th, Cape Isabella was rounded, and Markham landed to look for the mail, of which he obtained only a part, as he omitted to examine the cairn on the summit of the cape. The two vessels, now fairly clear of Smith Sound, worked slowly to the southward in the teeth of a persistent head-wind, and entered the harbor of Goodhaven, on Disco Island, on the 25th of September. On the 2d of the following month they were both anchored at Portsmouth.

The results obtained by this expedition are of high value, both with regard to physics, geography, and natural history. Captain Feilden and the other naturalists of the party made extensive zoölogical, botanical, and geological collections; the last are of special interest, as they furnish the proof that Grinnell Land had a flora during the Miocene period similar to that of Spitsbergen, so ably described by Heer. Twenty-six species of plants were discovered in a seam of Miocene coal of great extent and thickness, exposed in a valley about two miles north of Discovery Harbor. The coal itself is pronounced to be equal to the best Welsh coal for steaming purposes; it has 61 per cent. of coherent coke; it cakes when heated, and leaves only 6 per cent. of ash.

The different expeditions hitherto considered furnish us with the material for a geographical sketch of the region in question; but for

brevity I shall limit myself to giving a short account of the condition of the ice and of the general character of the currents.

The character of the land bordering Smith Sound and its northern extension, is eminently that of a high-mountain region. By far the greater part of the Greenland coast may be termed a high plateau, rising to an altitude of probably not more than 7000 feet, as far as can be judged, from the present extent of our knowledge; but Ellesmere Land and Grinnell Land exhibit steep and lofty peaks, which are mostly isolated, from 2000 to 3000 feet high. Only two actual ranges of mountains have hitherto been noticed; one, the Victoria and Albert Mountains, the other, the United States Range, the highest peak of which, Mount Grant, is probably not over 3000 feet high. They both follow the general trend of the coast at a distance of some forty or fifty miles. Besides this striking difference, which would be noticed even by the most superficial observer, we see, furthermore, that Greenland, which has probably its highest elevations on its east coast, is covered by an ice-cap, while the coast opposite shows comparatively few glaciers. Before the return of the English expedition, it was not known that primary glaciers existed on Grinnell Land, at least not north of Hayes Sound.

Our present knowledge as to the depth of Smith Sound and its extension towards the north and south is still limited, but we are probably not much mistaken in assuming that the average depth of the sound is not less than 250 fathoms. By means of the cotidal hours of nine stations, Mr. Schott, according to Airy's formula, computed the average depth of Davis Strait to be 418 fathoms; that of Baffin Bay he finds to be 349 fathoms, and that of Smith Sound, between Van Rensselaer Harbor and Port Foulke, is 277 fathoms.* The average depth of Davis Strait and Baffin Bay is therefore about 383 fathoms.

The mean specific gravity of the water in Smith Sound, derived from 54 surface observations made by the Polaris, between August 12 and 28, 1872, between latitude 81° 35′ N. and latitude 79° 36′ N., is 1.02155, which is somewhat less than we might expect *a priori*. But we must take into consideration the time of the year at which these observations were made, and the fact that the vessel was always surrounded by ice. In only two instances was the temperature of the air below 32°, while during the rest of the period it was sufficiently warm to melt the ice; consequently the surface-water was rendered lighter than it would have been under other circumstances.

* Hayes' *Physical Observations*, p. 164.

According to Börgen, the mean specific gravity of the sea of East Greenland is 1.02411, north of the equatorial limit of the ice, while it is 1.02493 between the latter and the Arctic circle; and for Robeson Channel, during the winter of 1875–76, Sir George Nares found it to be 1.02245, which nearly agrees with our own value. The absolute maximum density experienced by the Polaris was measured at noon on the 20th of August, and amounted to 1.0288, which corresponds with the mean bottom density of the oceanic basins. Based on his own observations, Captain Nares comes to the conclusion that with the increase in temperature of the water, below thirty fathoms, the density also increases to above that of the polar water, which numerous observations made during the winter showed to be 1.02245. He concludes furthermore that the bottom water is derived from the Atlantic Ocean.* Eighteen observations made by the Polaris during the period above mentioned, in various depths, ranging from 6 to 203 fathoms, show a similar increase in density with the depth, although not at a regular rate. Whether these irregularities are due to undercurrents or to errors of observation will have to be decided by future investigations.

If we now examine the current system of the region in question, in its latest representation on Berghaus' Chart of the World, which embodies an admirable amount of details in the most instructive manner, we perceive that the west coast of Greenland is swept by a warm current. This warm current is represented as part of the Gulf Stream, consisting principally of two branches; the westernmost crosses the parallel of Cape Farewell between longitude 50° and 60° W., while the other sweeps the northwest coast of Iceland, whence it takes a westerly and southerly direction, and, passing round Cape Farewell, joins the branch first mentioned. Sweeping the west coast of Greenland, it can be traced to Cape York, whence it sets west towards the entrance of Jones Sound, from which we notice a cold current to issue, sweeping the shores of Baffin Land and Cumberland. In setting south, it is joined by another cold current issuing from Hudson Strait, and, designated as the Labrador current, it continues its way along the coast.

Besides these two main currents, we notice two subordinate cold ones; one runs across Davis Strait near the 70th parallel, while the other, a branch of the East Greenland ice-stream, runs along the southwest coast of Greenland, between the latter and the warm

* Nares, Vol. II., p. 158.

current before mentioned, nearly to the Arctic circle, one of its branches joining the Labrador current near latitude 60° N.

The materials on which the direction and velocity of these currents are based are derived from different sources; but evidently some portions were laid down by theory only. Before going any further it may be advisable to investigate briefly how much reliance can be placed in general on current observations made under ordinary circumstances in the Arctic seas. The vessels cruising in the region in question are either discovery-ships, whalers, or a few trading-vessels of the Danish Commercial Company. With few exceptions the discovery-ships are usually under strict orders, and are not allowed to deviate from their course or to make investigations; while the whalers, after they reach the ice, take hardly any astronomical observations, and never use their log-line. If a discovery-ship is not bound by orders, her commander may always have a certain plan which he can follow and to which he can make everything else subordinate; but unless this plan be the study of the physics of the sea, we can hardly expect any accurate observations. Cases like the latter are of rather rare occurrence, and there are but few on record. But even if a vessel starts purposely to make the observations in question, she will, in a great many instances, have to encounter physical obstacles that render the observations unreliable; often it will be quite impossible to make any observations.

The direction and velocity of currents are usually obtained by taking the difference between the position of the vessel as found by dead reckoning, and the position as determined by astronomical observations. A less common method is that of making actual experiments, which require much time and care. Owing to unavoidable errors of the dead reckoning, the former mode is far from accurate under ordinary circumstances, and it decreases in value if the vessel has to make her way through ice, when the log is rendered useless, and when she has to change her course so frequently that in some instances it is almost impossible to keep an accurate reckoning.

Those observations obtained when the vessel is beset in the ice and drifting are more valuable; but it is only under favorable circumstances that they give an accurate idea of the true velocity of the current. If there are many bergs scattered through the pack, the direction and velocity of the surface-current, as determined by two astronomical observations, may be considerably affected by undercurrents acting on the submerged parts of the icebergs; and the wind

will act on the exposed portion of the berg as on a sail, and thus in many instances solely determine both the rate and direction of the drift. The latter may also be greatly affected by the action of the tide, especially if the vessel is beset in a narrow channel.

To demonstrate the character of the currents in Kennedy Channel, Kane's Basin, and in Smith Sound, I shall herewith give an analysis of the drift of the Polaris. From midnight of August 14, with a light wind from SW., when the vessel got beset, till the evening of the 18th, between latitudes 82° 2′ and 79° 44′, the mean direction of the drift was almost SW., or more accurately, S. 42° W. Between the 14th and 16th it was either calm, or light winds were blowing from the NE., SW., and from S., most likely too light to affect the drift, the rate of which during the two days in question was five miles, decreasing to one mile during the following 48 hours, and rising to 14.4 between the 17th and 18th. This latter velocity is the greatest on record, and as fresh northerly breezes were experienced during the time, we may reasonably suppose that they accelerated the rate of the current, the more so as its direction remained the same as during the three preceding days. Most likely the increased velocity is also due to the action of the spring-tide, the moon being full at 8h. 53.2 m., on the 18th; and as a rule the set of the flood was found to be stronger than that of the ebb, the former being southerly. During the afternoon of the 18th a prime vertical observation was obtained, so that the position of the vessel could be fixed as accurately as the low altitude of the sun permitted. At 6 P. M. she found herself in latitude 79° 41′ N., longitude 70° 19′ W., and from this time during the following 48 hours the direction of the drift suddenly changed to about W. 17° N., the velocity decreasing to about 2.3 miles. Between noon of the 20th and noon of the 21st, the direction changed again, it being almost due SE., the velocity having increased but slightly, and all the wind recorded during this time being from the north. Another change of both direction and velocity took place between the 21st and 23d, the former becoming E. 9° S., and the latter having increased from 3 to 6.5 miles, while the resulting direction of the wind during this time was almost at right angles to the set of the current.

While up to this time the rate of the current was never less than one mile during 24 hours, we see that it decreased to almost one-half of this velocity during the period from August 23 to September 6, the wind being very light during the whole time, with the exception of two instances, when fresh breezes from SW. are recorded.

The whole difference of latitude made during this fortnight was only five miles, the direction of the set being very variable and apparently quite independent of the wind. This rather remarkable change finds its explanation in the meeting of the eastern and western Atlantic tidal waves, and Sir George Nares has found by observation what I had proved theoretically, viz., that the two waves meet near Cape Frazer.

Between September 6 and 8 the direction of the set was about W. 10° S., the rate increasing again to 2.5 miles and remaining the same until the 14th, although the resulting direction changed to almost SW., the wind being north during the greater portion of the time. From the latter day to October 2, the direction was nearer to that of the meridian than in any of the other instances, the velocity decreasing from 2.5 miles to 1.5, becoming as small as one mile between September 24 and October 2.

The vessel, continuing to drift towards the coast, followed its trend very closely from the 8th till the 13th, the velocity increasing to 85 miles, most likely accelerated by the wind, which was from the northeast. The last observation on record is a meridian altitude of the sun taken on the 12th, and placing the ship in latitude 78° 28′ N., about 6 miles off Cape Hatherton. Increasing her distance from the shore, as a glance at the map will show, she began to drift to the west side of the channel, taking a somewhat northerly direction, partly caused by a fresh breeze from northeast, which finally changed into a southwest gale. Towards evening she was carried north to the vicinity of Lifeboat Cove at the rate of at least three miles an hour; but most likely this speed was not only due to the influences of the wind, but also, and perhaps principally, to the flood current, it being the time of spring-tide.

In the same latitude, a little to the eastward of our position, Inglefield experienced a northerly set of 3 miles, which we do not hesitate to assign to the same cause, as a permanent current of such a velocity does not exist at this place. In the spring of 1873, when travelling from Polaris House to the Eskimo settlement, Sorfalik, where we remained a short time, we paid special attention to the motion of the ice, which, during the time of slack-water, was invariably towards the south. The same direction of the set, only at a greater rate, could be noticed when the tide was ebbing; when the tide was rising, the ice drifted in the opposite direction at a speed of about four miles an hour.

From the preceding observations, it becomes evident that the

resulting direction of the current is southerly, even between Port Foulke and Cairn Point, where Petermann supposed the existence of a branch of the Gulf Stream.

That there is no warm current north of Cairn Point was proved by numerous observations taken on board of the Polaris before she reached her second winter-quarters. But we may properly ask, what are the conditions south of that locality? If the eastern shores of Smith Sound are washed by a warm current, this current will necessarily have to enter the Sound from the southward. I must confess that I have no actual current-observations to offer here, but as the Gulf Stream is partly characterized by a high temperature it can be traced by the thermometer. During our retreat in the boats from Polaris House to Cape York, between June 3 and 21, I measured the temperature of the sea as frequently as was necessary; I found it either invariably at that of the freezing point of fresh water or even below 32° F. The existence of the Gulf Stream between Cape York and Polaris House is therefore out of the question. But might not a warm current enter Smith Sound to the westward of the track of the boats?

To this we can positively answer, no, for we found the temperature of the sea in no instance above 31.6° when crossing from Cape York to the coast of North Devon, during the first part of July. Had there been any traces of a warm current we should have found them beyond doubt, as we usually took observations every hour, or even as often as every half-hour, when the color of the water showed any changes.

According to these observations, the Gulf Stream does not extend north of latitude 75° 5′; but how far it reaches cannot yet be stated, as our own meteorological observations bearing upon this subject are lost, and the materials thus far published are hardly sufficient to settle this question definitely. In McClintock's *Meteorological Observations* we find the following remark made on the 7th of July, 1857, the Fox being in latitude 66° 6′ N., longitude 15° 1′ W.: "The temperature of the sea-surface varied from 56° to 61° during the day. At noon the following day the position, by observation, was 10′ to NE. of the dead reckoning. The yacht, therefore, was probably on the northern limits of the Gulf Stream." An examination of the same register shows, however, that afterwards higher temperatures were noted till the vessel had passed the parallel of Upernivik, when the water again became colder. Some manuscript observations, kindly furnished to me by Captain von Otter, of the Swedish Navy, seem

to indicate the same conditions; and until we shall have some more complete data, we shall hold the opinion that the Gulf Stream does not enter Melville Bay.

In order to solve the Gulf Stream question in a satisfactory manner, the observations on the temperature of the sea ought to be accompanied by determinations of the specific gravity of the water, because in many instances the high temperature alone is not sufficient to prove the existence of the Gulf Stream. We have shown that there is no warm current entering Smith Sound, and still we found that on several occasions the temperature of the water at Polaris Bay was astonishingly high. On the 2d of August, at 3 P. M., we noted a temperature of 51.9° along the shore, a little south of our anchorage and opposite a ravine named the Second Ravine, but at the same time the water was almost fresh.

We made similar observations along the Greenland coast between Disco Island and Upernivik, and in every instance we noticed that these warm spots were almost destitute of animal life, which was abundant where the percentage of salt was normal. How this high temperature is imparted to the water is easily perceived.

It is greatly to be regretted that the current observations of the expedition under Sir George Nares have not yet been published, for it is still hardly possible to make his observations agree with ours. At noon of July 26, 1875, the Alert, when about fifteen miles southwest of Wolstenholme Island, obtained a surface temperature of 40°, and when near the Cary Islands, on the same day, she found a stratum of water of a temperature of about 39°, extending to a depth of 12 fathoms.* When on their way home on the 16th of September, 1876, Sir George obtained a temperature of only 27°, almost at the same place where it had been 12° higher the year previous, while he found a belt of water of a temperature of 34°, almost fifty miles wide, half way across Baffin Bay on the parallel of Jones Sound.

According to these observations, it appears that the currents in the region in question are subject to great changes. If it were possible to trace a connection between the changes of these currents and the cool and warm summers in West Greenland, some other highly interesting problems might easily find their solution.

Let us now briefly consider the condition of the ice.

The ice met by the Polaris in Robeson Channel was of a different character from that which baffled the heroic efforts of the British

* Nares, *Voyage*, Vol. I., p. 44.

explorers. It is true that Hall, in October, 1871, noticed some ice in Newman Bay which he called "*century-old ice, that, commencing from one side of the bay, spreads over to the other*";* but we met only in a few instances with those formations called floe-bergs by Sir George, and I cannot be easily convinced that the condition of the ice in Lincoln Sea is always such as it was found in 1875 and 1876. That ice of such immense thickness should form according to the regular freezing process is contrary to all physical law. The ice formed on the surface of the sea is subject to regelation similar to that of glacier ice. Where the pressure is strong, high hummocks will be produced, and the snow, under the influence of the wind, will be deposited and packed between the hummocks and form drifts, which are subject to the same changes as the névé of a glacier; and how heavy the pressure is in the region in question may easily be noticed if we examine the high walls of ice pressed up at various places along the shores of Smith Sound. In Melville Bay I noticed comparatively smooth floes, which projected some ten feet above the level of the sea, but their height was due only to the masses of ice that had been pressed under them. The floe-bergs evidently form in the same manner. Under the influence of the prevailing winds and the currents, the lighter ice necessarily escapes from Lincoln Sea, while the heavier masses will get aground, and may remain in that position for several years. The ice in the Polar Basin necessarily has a tendency to drift towards the equator, and there is no reason to assume that the ice-cover of the sea in close vicinity of the North Pole should be more dense and impenetrable than in lower latitudes. For, the higher the latitude, the longer the sun will be circumpolar, and therefore, although its altitude may be low, the sum of heat received by the surface of the sea or land will be greater. I do not wish to be misunderstood, as I do not believe in an "*Open Polar Sea*"; but neither, on the contrary, do I believe in a sea covered by impenetrable ice year after year.

The sounding obtained by Markham when he reached his northernmost position, and the hummocks discolored by mud noticed by the northern division, seem to indicate the presence of land to the northward of the highest latitude attained by this gallant explorer. If any land exists there, it will probably be an archipelago, separated by more or less narrow bodies of water, whose ice-cover may be stationary for several years in succession. If, then, an abnormal

* *Narrative*, p. 167.

season should occur like the one experienced by Sir George, as may be proved by the westerly winds, these channels will be cleared and the ice will drift to the southward.

I have repeatedly alluded to the character and motion of the ice as found by the English expedition in 1875 and '76. Between 1871 and '73 the conditions were different and the various channels were never entirely frozen over. If we take the prevailing direction and force of the wind into consideration, and if we remember that Robeson Channel and the others adjoining it are narrow, and, comparatively speaking, very deep, thus giving occasion to a swift tidal current, we can hardly expect anything else. During the winter and spring of 1871–72, the only stationary ice near our winter-quarters was found along the shore, extending in a narrow belt from a few miles north of Cape Lupton, along the shores of Polaris Bay, to the mouth of Petermann's Fjord, and growing very hummocky near Cape Lucie Marie.

South of Cape Morton, along the northwest coast of Petermann's Peninsula, it was found a little smoother in April, 1872, although intersected by lanes of water, while there was hardly an ice-foot along John Brown Coast; a travelling party trying to reach Cape Constitution was stopped by open water and had to return. As far as the observations made at Polaris Bay and Newman's Bay go, the ice in the channel was adrift during the greater portion of the time; it was stationary only on a few occasions during March, when the temperature was low and when there was not much wind.

Owing to the combined action of currents and winds, the ice forming in deep channels, flanked by steep shores, will always be found hummocky; and, indeed, in Robeson Channel and Hall's Basin it was of the worst description. It was rougher than that of Smith Straits, the bad condition of which prevents the natives living near Cape Alexander from crossing the strait, barely thirty miles wide, and from communicating with the Eskimos inhabiting the region of Ellesmere Land near Cape Isabella.

During the spring and summer of 1872, the sea in Hall's Basin and Robeson Channel was in such a condition that during the navigable season, the lanes of open water intersecting the ice were hardly wide enough to permit a boat to be launched, while they were too numerous and the ice too rough to encourage sledge-travelling.

In Hall's Basin the drift of the ice was in most cases southerly, accelerated by northeast winds and the flood-tide, which runs stronger than the ebb. The influence of the latter is less marked, and it was

only when the returning ebb was accompanied by southerly winds that the ice drifted with the same velocity in a northerly direction as in the opposite one. During the stay of the boat-party at Newman's Bay, the direction of the drift was also southerly, with the exception of a few occasions during the time of spring-tides, when a slow motion in the opposite direction could be noticed for a few hours at a time.

During the latter part of the summer of 1872 the condition of the ice was less favorable to navigation than during the preceding year; but between the 16th of August, when the vessel was beset, till the middle of September, lanes of open water of greater or less extent could be noticed almost daily along the coast of Grinnell Land. To reach them by the vessel was, however, impossible, owing to the absence of westerly winds, upon which the navigation of Smith Sound almost wholly depends.

When the boats left Polaris House, June 3, 1873, they coasted at a distance of from one to four miles from the shore in clear water, meeting floating hummocks only occasionally, although the pack was in sight nearly all the time to the west. Arriving at Cape Saumarez, the solid land-floe was met, stretching along the meridian of this cape as far south as Northumberland Island. To the northwest of this island and of Hakluyt Island, a considerable pack had accumulated, and the boats met more or less loose ice on their passage, most being encountered off Whale Sound, which, on the 12th of June, was still covered by the solid floe, extending from a short distance north of Cape Parry along the shore and across Booth Sound to Blackwood Point. For about eight miles south of this locality the coast was perfectly clear of ice; then the fast land floe was encountered, stretching to the northwesternmost extremity of Saunders Island, and in the direction of the meridian to the eastern portion of the north coast of Wolstenholme Island, while Dalrymple Rock was accessible. The floe appeared again at the southeast point of Wolstenholme, extending southeast to about longitude 72.5° W. As the boat's track from Wolstenholme Island to Cape York led always along the margin of the land-floe, which was smooth and very level, a glance at the map will show how far the latter extended to the seaward.

In one of the preceding chapters I have mentioned the occurrence of a seam of tertiary coal in Lady Franklin Bay, discovered by

the British Expedition under Sir George Nares. Shortly after the return of the English vessels a Lieutenant of the Army, then property and disbursing officer of the U. S. Signal Office, advocated a plan to reach the North Pole via Smith Sound, which was mainly based on the existence of the coal seam near Discovery Harbor.

This plan, termed the Howgate plan, was devoid of all sound originality. The valuable parts of it are based on the work of Hayes and Weyprecht; the rest, emanating from the brain of Lieutenant Henry W. Howgate, bears testimony that the originator of the "*Howgate Plan*" was not familiar with even the rudiments of Arctic exploration. This indigestible hash of reasonable and ridiculous views, after having been thoroughly mixed by Howgate, was seasoned by the daily press and made palatable to the public at large. Finally it was put into shape by a well-known penny-a-liner and presented in pamphlet form to the forty-fourth Congress.*

On page 6 of the pamphlet is written the following sentence: "*There prevails, indeed, even now, among the Esquimaux, traditions of lands far north of their own, inhabited by a people superior to themselves in knowledge and intelligence; lands where long-bearded men fatten the musk ox, and where churches and clocks are found.*" The author of the above does not hesitate to slander the most experienced Arctic explorers in various other paragraphs of the same publication. He points out their shortcomings and errors, and advises their successors how to avoid them, and what to do. He enumerates the causes of failure, and discusses after his own fashion the severity of seasons, the loss of time, and the hardships endured between the starting points and the regions proximate to the field of discovery; the lack of anti-scorbutics, lack of proper discipline, the failure to employ Eskimos, and the imperfect means of communication between the various field-parties. He proposes to send a party of fifty officers and men, or more, regularly mustered into the U. S. Army; an astronomer and two naturalists; one or two members of the regular force to be selected with reference to their ability in meteorological observations and telegraphy; skilful surgeons with supplies of medicines; a number of Eskimos, and an ample supply of Eskimo dogs. Provisions are to be stored for three years, though an annual visit from the United States is suggested as desirable. A strong portable building is to be carried to the station; two miles of wire to establish

* Polar Colonization and Exploration, by H. W. Howgate.

telegraphic communication with desirable points; and, of course, full sets of instruments and equipage, to make the parties efficient in all pertaining to the work of the expedition.

The plan of operations suggested is a sledge journey between the base of operations and the Pole, arranged in eight stages, fifty miles apart. It is proposed to start eight sledges laden with provisions; a portion of the provisions is to be cached at the first station and the sledge sent back; the second sledge is to leave its surplus at the second station and then return, and, following out this plan, only one sledge with ten or more men will continue throughout the journey, and, having made the necessary observations, will return. The caches are to be visited on the homeward route and provisions taken as needed.

International coöperation is referred to in the pamphlet, but not discussed, save with reference to projected independent voyages by other nations. The projector asks Congress for the sum of $50,000 —an inconsiderable amount indeed, if compared with the cost of previous expeditions fitted out. On the 8th of January, 1877, Mr. Hunter, of the House of Representatives, actually introduced a bill to carry out Howgate's plan. He asked for the sum above named, and for a vessel to convey the party; but the bill, although favorably reported from the Committee on Naval Affairs of the House of Representatives, failed to pass.

Howgate, bound to keep himself before the public, now freely applied to the public for support, and, according to his own statement, received a sufficient sum of money* to fit out a small preliminary expedition to Cumberland Gulf to collect the necessary supplies for the final voyage.

The expedition left in the schooner Florence, which had been purchased and fitted out for the purpose, and returned after a year's absence; but Congress had not felt inclined to favor the enterprise and give it the support asked for by its advocate. Congress could hardly have acted otherwise, for, as soon as Howgate had made his plan public, some of those familiar with Smith Sound, with its ice, and the chances of its navigability, pointed out the folly of the scheme.

At the risk of being indiscreet, I shall here quote a passage from a letter of Capt. Albert H. Markham, R. N., whose experience in the navigation of Smith Sound is second to none. On the 24th of February, 1877, Markham wrote to me from London, regarding the so-called Howgate plan: "It all reads and sounds very well, and per-

* Cruise of the Florence, p. 5.

haps may delude the inexperienced public; but speaking as an arctic man myself, I must confess that the scheme is utterly impracticable, and one that could only emanate from the brain of a conceited man desirous of notoriety, who has compiled his pamphlet from the works of others and brings it out as his own originality."

After Howgate had discovered that the opponents of his plan in Congress could not easily be snared, he changed his tactics. He now tried another bait. Purchasing for a mere song a small Clyde steamer in Scotland, which was brought to this country early in 1880, he caused another one of his friends to introduce another bill on his behalf in which the following passage is of some interest: " . . . . . Provided, That the President of the United States is authorized to accept from H. W. Howgate, and fit out for the purpose of this expedition, the steamship Gulnare, which vessel shall be returned to its owner, when the object of the expedition shall have been accomplished, or when, in the opinion of the President, its services are no longer required."*

This was by no means a bad speculation on the part of Mr. Howgate, as the cost of fitting the vessel for Arctic navigation proved afterwards to be over four times the amount he paid for her. While the bill was being discussed in the House of Representatives an opportune article appeared in the New York *Herald*, of which every member found a copy on his desk when taking his seat. Previous to that a number of other impartial but biting articles had been published. When Howgate most certainly expected to see his bill pass, it was miserably defeated. Those who opposed it showed much good judgment in so doing, and whether they opposed it on general principles or on some special ground, is not of much consequence in this instance, for Lady Franklin Bay should have been the last place chosen as a permanent or temporary station.

In the first instance it could never have been made self-supporting, as Howgate expected; for, the game inhabiting the land in those latitudes, even if comparatively plentiful at first, would very soon be exterminated; and the spoils of the sea are so scant that the Polaris and the two vessels under Sir George Nares did not secure over twenty seals in the course of two years. The birds too are not found in such great numbers as farther south; the northernmost rookery of the little auk is in Foulke Fjord, and the sportsmen of the Alert while in winter-quarters obtained only one hundred and nineteen birds, and

* Compare "Appendix," pp. 3 and 4.

those of the Discovery not more than eighty-four. If any geographical discoveries were to be made, the exploring parties would necessarily have to go first over the ground explored by the eastern and western English division under Beaumont and Aldrich, before entering a new field; and they would have to traverse the hummocky ice of Lincoln Sea to get beyond Markham's farthest point, reached in 1876. As another reason why Lady Franklin Bay should not have been chosen as a station, it is sufficient to state that in Smith Sound and its northern extension, the meteorological stations are more numerous than anywhere else in high northern latitudes. At that time there were six: *Floeberg Beach, Discovery Harbor and Polaris Bay, Rensselaer Harbor, Polaris House, and Port Foulke*, and all these within less than four degrees of latitude. If Howgate had proposed to provide his party with a steamer to winter at the station, and not *to be returned to her owner, after having landed the expedition*, there would have been at least *one* redeeming feature in his scheme; for then the colonists might have seized the first favorable opportunity to explore the region to the northward of Lady Franklin Bay.

Notwithstanding the deathblow the bill had received both in the Senate and in the House, Howgate still bore his banner with the utmost temerity. One morning the leading newspapers of the country, through the Associated Press, published the surprising statement that "Captain" H. W. Howgate would fit out the Gulnare at his own expense. And a surprise it was; especially to those who had been familiar with the straitened circumstances of Howgate, who, at one time a poor carpenter, had risen from the ranks to the grade of a first lieutenant, with pay not over-abundant. In what manner the money to fit out the expedition had been obtained was unknown at the time, but not many months elapsed ere the mystery was revealed.

The Gulnare had anchored in the Potomac opposite one of the wharves, and from my working room in one of the towers of the Smithsonian Institute I had her constantly in sight. Howgate had given strict orders not to allow any one to visit the vessel, but, in company with Mr. Chester, who had been first mate of the Polaris, and who had finally helped to fit her out, I went on board. Clad in the humble garb of workmen we succeeded in allaying the suspicion of the guard, and thoroughly examined the vessel, pretending to be mechanics sent by Howgate. She was taken to Alexandria to be rebuilt. After her boilers had several times been condemned by the inspecting

officers, she finally left with flying colors, but under different auspices than Howgate had expected; for the Secretary of the Navy refused to furnish the necessary complement. In a disabled condition she returned in the fall of the same year, leaving the surgeon and one of the scientific members at Disco.

Meanwhile the International Arctic Congress had for the first time been in session, at Hamburg. During the meeting of the meteorologists at Rome,* General Albert J. Meyer, then Chief Signal Officer of the Army, had made the acquaintance of Lieutenant Charles Weyprecht of the Austrian Navy, the originator of the plan of polar stations. The Austrian explorer subsequently addressed to him a letter, dated Trieste, May 20th, 1879, requesting him to induce the U. S. Government to take an active part in the proposed investigations of the Polar Regions. This letter was answered by the Chief Signal Officer on September 8.† It contains the statement that the Department would be willing to coöperate with "any State or States or responsible parties in extending in this manner the system of simultaneous observations, and will favorably consider the subject of a station at Point Barrow."

There is no evidence that the Chief Signal Officer of the Army up to that time expected to include Lady Franklin Bay in the cordon of meteorological stations; but the influence exerted by Howgate seems to have been so powerful that he finally concluded to do so. From a historical point of view it will be interesting to the student of Arctic exploration to compare the letter of General Meyer‡ to the Secretary of War, with the House Report No. 89,§ and the substitute for the House Report No. 1823.‖

I have perhaps dwelt longer upon the Howgate plan than I should have been justified in doing under ordinary circumstances; but I had to discuss it at some length, for it fatally influenced further Arctic exploration, as we shall presently see. That this plan would lead to disaster was pointed out by myself and others at an early date; but the judgment of the Chief Signal Officer in Arctic matters was considered supreme, and upon him rests the responsibility of its failure. Several names connected with the Signal Office will not easily be forgotten in Arctic history.

*Appendix, p. 137.
†*Loc. cit.*, p. 138.
‡P. 138 *et seq.*
§*Loc. cit.*, p. 142.
‖*Loc. cit.*, p. 149–50.

Finally it was decided to establish a station at Lady Franklin Bay, besides the one at Point Barrow, and, by Special Order No. 57, First Lieutenant A. W. Greely, Fifth Cavalry, Acting Signal Officer, was assigned to the command of the expeditionary force then organizing under provisions of the acts of Congress, approved May 1st, 1880.*

The first paragraph of Greely's general instructions† reads to the effect that "the *permanent* station will be established at the most suitable point north of the eighty-first parallel and contiguous to the coal seam discovered near Lady Franklin Bay by the English Expedition of 1875."

I have quoted this paragraph in full to show how thoroughly the present Chief Signal Officer had imbibed the idea of Howgate.

The steamer, to be chartered in Newfoundland, was to touch at Disco or Upernivik in order to obtain Eskimo hunters, dogs, clothing, and various other necessaries, and was then to proceed northward, making only such stops as the condition of the ice would necessitate or such as would be essential in determining the exact location and condition of the stores cached on the east coast of Grinnell Land by the English expedition of 1875. Greely was furthermore directed to supplement the English depots by small caches from the steamer's stores and provisions, in case he should be delayed by the condition of the ice, and to leave three brief notices of his visit; one to be deposited in the cairn built or found standing, one to be placed on the north side of it, and one to be buried twenty feet north (magnetic) of the cairn. After arriving at the permanent station the steamer was to discharge her cargo with the utmost dispatch, and, having allowed the remaining party to make a careful examination of the seam of coal, she was to return to St. Johns, N. F.

The first duty of the party would then consist in erecting the dwelling-house and the observatories, and in making an attempt to reach the "high land near Cape Joseph Henry" by sledges. The sledge-parties were to work in the interest of exploration and discovery, and to make accurate surveys of the unknown parts of the country.

Regular meteorological and other observations were to be maintained uninterruptedly, in accordance with instructions issued to

* *Loc. cit.*, p. 141.

† Instructions No. 72, dated Washington, D. C., June 17, 1881. "Appendix."

Signal Service observers and with those published by the Board of the International Arctic Conference. It was contemplated to send a vessel in 1882 and 1883 to visit the station, and to carry supplies. In case she should be unable to reach Lady Franklin Bay during the first year, she was to cache a portion of her supplies and all of her letters and dispatches at her most northerly point on the east coast of Grinnell Land, and to establish a small depot of provisions at Littleton Island. Notices of such depots and their localities were to be left at Cape Hawks, Cape Sabine, and at Cape Isabella, or at any one of these points, if all should not be accessible.

The paragraph of the general instructions relating to the movements of the vessel, to be eventually despatched in 1883, is of vital importance, as we shall see hereafter, and I shall therefore quote it in full. It reads as follows:

" . . . . . the vessel sent in 1883 will remain in Smith Sound until there is danger of its closing by ice, and, on leaving, will land all her supplies and a party at Littleton Island, which party will be prepared for a winter's stay, and will be instructed to send sledge-parties up the *east side of Grinnell Land* to meet this party. If not visited in 1882, Lieutenant Greely will abandon his station not later than September 1, 1883, and will retreat southward by boat, following closely the *east coast of Grinnell Land*, until the relieving vessel is met or Littleton Island is reached."*

For the purpose of conveying the expedition, which consisted of three lieutenants, three sergeants, four corporals, and nine privates, to Lady Franklin Bay, a sealing steamer was chartered at St. Johns, Newfoundland. This was the Proteus, built at Dundee, in Scotland, in 1874. She was barkentine-rigged, and had a registered tonnage of 467 tons and a gross tonnage of 619 tons. She had been expressly built for ice-navigation; she was provided with a sheathing of iron-wood from above the water-line to below the turn of the bilge; her prow was armed with iron, and she averaged 8½ knots.† Commanded by Captain Pike, an ice-master of great experience, she left St. Johns at noon, July 7, and reached Godhaven nine days later. The only ice seen south of Cape Farewell were a few bergs off Funk Island; the pack was encountered at 10.30 P. M., July 12, lat. 61° 30′ N., long. 53° 30′ W., and was left behind at 3 o'clock

Loc. cit., p. 7.

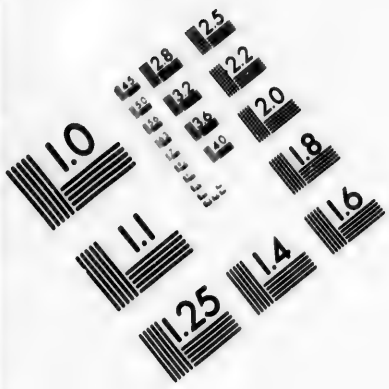
†For description of vessel compare "Appendix," Inclosure i., pp. 22, 23.

the next morning. A second mass of pack was met at 2.30 P. M. the same day and passed through in an hour. Dr. Octave Pavy, who had been left by the Gulnare at Disco, joined the expedition as acting assistant surgeon on the 20th, and after twelve dogs, to which nine more were subsequently added, and other necessaries had been taken on board, the Proteus weighed anchor and left the colony on the 21st for Rittenbenk, where Henry Clay, who had wintered in Greenland with Dr. Pavy, also joined the ship.

On July 24th the Proteus was at anchor at Upernivik. Lieutenant Lockwood proceeded to Pröven in the steam launch and secured the services of two natives; he also obtained ten dogs, five of which died shortly afterwards. The weather reports were extremely favorable; the winter had been uncommonly mild, and according to the statement of Mr. Krarup Smith, the Inspector of North Greenland, "Upernivik had never been so green in fourteen years."* On the afternoon of July 29 the anchorage of Upernivik was left, and at 7 P. M., having run through the south passage, the vessel was distant three miles from this settlement. Running northward for a few hours, the middle passage was taken, and at 7 A. M., July 31, the engines were stopped, as the dead reckoning placed the vessel only six miles north of Cape York, and the land was hidden by dense fog. When it cleared, an hour later, the land proved to be about five miles distant. The transit of Melville Bay had been made without any difficulty and in the remarkably short time of thirty-six hours. The only pack seen was sighted in latitude 75° 08′ N., longitude 63° 40′ W., but it lay to the westward of the ship's track, and it was not possible to discern from the masthead whether it was solid or loose. In the course of the afternoon two parties were landed on the southeast island of the Carey group. One party, under Dr. Pavy, found the cairn left by Sir Allen Young, while the Commander, in company with Lieutenant Lockwood, examined the whaleboat and depot of provisions left by Sir George Nares, which they found in good condition.

Shortly after midday on the 2d of August, Littleton Island was reached. An exhaustive search of seven hours revealed the English mail, contained in four boxes and three kegs. It was taken on board to be forwarded to England. A small cairn found close by did not contain any records. On the southwest side of the island, facing Cape Alexander, about 6½ tons of coal were landed. A party visiting the old winter-quarters of the Polaris, to communicate with the natives,

* Appendix, p. 27.



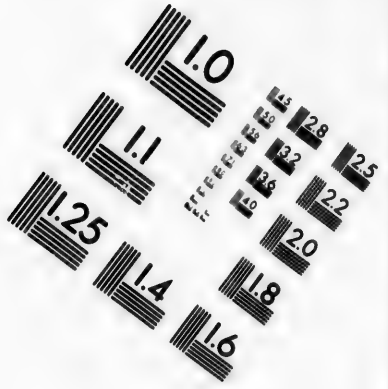
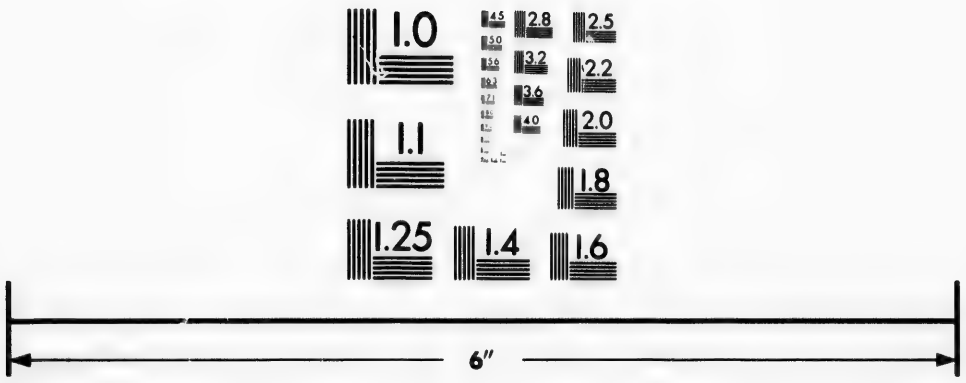


IMAGE EVALUATION TEST TARGET (MT-3)



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found that they had left. The party brought back a number of relics, among them the transit instrument, which was picked up near our old cairn. This cairn, like the cache containing our records and instruments, had been overlooked by Captain Greer and his party when in search of us.

Some repairs to the wheel of the vessel caused a delay of several hours, but nevertheless Littleton Island was left at 10.45 P. M. There was no ice visible; the weather was fair and the Proteus made a direct run for Cape Hawks, without examining the depot of 240 rations left by Sir George Nares at Cape Sabine. The next landings made were at Washington Irving Island and Cape Hawks. The stores and provisions left by the English expedition at the latter place were found in comparatively good condition, except the bread, which was somewhat mouldy. Here were taken on board the jolly-boat belonging to the depot, a keg of Jamaica rum, and also some samples of provisions. The remaining stores were more perfectly secured to resist the weather. The vessel made a new start at 11.10 A. M., to pick up a party that had been left on Washington Irving Island, and then proceeded northward, passing Cape Louis Napoleon at 1.10 P. M., and Cape Frazer about two hours later. Through the openings of the fog, which commenced setting in, Washington Land was first sighted at about four o'clock. Dense fog prevented the commander of the party from visiting the English depot at Cape Collinson, where Sir George Nares had left 240 rations, and he was finally compelled to stop. When it cleared again, Franklin Sound was sighted and passed shortly before noon. At two o'clock in the afternoon the Proteus stopped at the northeast point of Carl Ritter Bay, where a depot of 225 bread and meat rations was established, on the first terrace of the shelving beach, north of a characteristic small creek. When off Cape Lieber the vessel encountered the first pack to interfere with her progress; it extended across the sound from Cape Baird to Offley Island, and consisted of heavy ice, ranging from 20 to 50 feet in thickness. The Proteus was moored to a floe; meanwhile a party went on shore to examine the ice, and Lieutenant Lockwood erected a cairn on the highest point near Cape Lieber. "*No other cairn could be seen on it or from it nor on other peaks visited by Dr. Pavy and myself*";* this is a further proof that Dr. Hayes did not reach the latitude he claims to have attained, for a cairn or its traces are

* Appendix, p. 28.

not easily obliterated. Its site would even be detected if it had been partly blown down or entirely demolished.

On August 6th the motion of the pack forced the vessel to make various changes of her mooring place. The next day she was driven out of Lady Franklin Bay, and on the 8th she slowly drifted south. About twenty-five miles of ice in huge fields passed southward of her during those two days. On the evening of the 8th the steady north wind packed the ice, which formed a close barrier, stretching from Carl Ritter Bay across to Hans Island. A nip appeared unavoidable. Preparations to unship propeller and rudder were made with all possible dispatch. During the night the conditions improved slightly, but during the 9th and 10th of August the Proteus drifted to within five miles of Hans Island. She had lost about forty-five miles of latitude. A southwest gale, accompanied by snow, finally drove the pack to the northward. This was on the 10th. When it cleared the next morning, the open water along the coast of Grinnell Land extended as far to the north as the eye could reach from the crow's-nest. The Proteus now made a new start and was fortunate enough to cross Lady Franklin Bay a little before three o'clock in the afternoon, when she entered Discovery Harbor by a narrow lane of water, left between the pack, which was jammed against the shore.

The Proteus had evidently made a most remarkable passage, having actually reached her destination in *six days and two hours, including the various stoppages*. While Lieutenant Lockwood examined Watercourse Bay and the coal seam, the Commander visited the winter-quarters of the Discovery. The former returned early in the morning of the 13th, reporting the place suitable for camp. The coal was easily accessible and could be sledged to Discovery Harbor or Watercourse Bay without great difficulty after the ice had formed. It was only with reluctance that Lieutenant Greely decided to settle at the winter-quarters of the Discovery, for the vessel, while being unladen, was exposed to all winds from NE. to SSW. Passing some two miles of heavy ice, the Proteus finally anchored towards three o'clock in the afternoon of the 12th about one hundred yards off the cairn left by the Discovery. Half an hour later the force was "divided into two gangs to work day and night by four reliefs until the cargo was discharged." The coal, of which the expedition had about 140 tons, was landed, and the work on the house was proceeded with, although but three or four men could be spared. Fourteen musk oxen had been killed, furnishing a quantity of meat sufficient

for seven months, if issued three times a week. In grateful remembrance of the lively interest that the Senator from Michigan had taken in having the station established, Lieutenant Greely named his camp Fort Conger.

On the 25th (?) of August the Proteus left for St. Johns, having two men of Greely's original force on board. As far as I have been able to ascertain, there are no documents in existence containing information as to the condition of the ice in Smith Sound during the homeward voyage. But the trip was evidently of short duration, for a telegram received at the office of the Chief Signal Officer at 9.43 A. M. on September 12, announced the safe arrival of the vessel at St. Johns.*

The last despatches sent by Greely entitle us to the highest expectations, for he had conducted the expedition under his charge with uncommon energy, great prudence, and good judgment. In a letter to the Chief Signal Officer he recommends that in connection with the vessel to visit the station in 1882, a captain of the merchant service should be sent who had had experience as a whaler and ice-master. He further requests that five enlisted men of the army be sent to replace invalids or men otherwise unfit for work. In case the vessel should be unable to reach Camp Conger she should be directed to leave a boat and a depot of provisions at some prominent point on the east coast of Grinnell Land, in the highest latitude attained. Another depot should be left at the western point of Littleton Island, and a second boat at Cape Prescott, or as near to this place as possible. After making the depot at Littleton Island, the vessel should, if possible, leave a record of its proceedings at Cape Sabine.

In case the party should not be able to visit Camp Conger in 1882, Lieutenant Greely proposes that the following year a capable, energetic officer should be sent with ten men, eight of whom should have had experience at sea, provided with three whaleboats and ample provisions for forty persons for fifteen months. In case the vessel, *which was not to leave Smith Sound before September 15th*, should be obliged to turn southward, she should establish two depots like those above mentioned; one between Cape Sabine and Bache Island, the other at a point intermediate between two depots already established, and marked by substantial scantling, well secured and braced, to the top of which pieces of canvas should be nailed, so that

*Appendix, p. 33. 3012 Misc., '81.

the depots could be easily discovered. "*The party should then proceed to establish a winter station at Polaris winter-quarters, Lifeboat Cove, where their main duty would be to keep their telescopes on Cape Sabine and the land to the northward. They should have lumber enough for house and observatory, fifty tons of coal, and complete meteorological and magnetic outfit. Being furnished with dogs, sledges, and a native driver, a party of at least six* (6) *men should proceed, when practicable, to Cape Sabine, whence a sledge party northward, of two best fitted men, should reach Cape Hawks, if not Cape Collinson. Such action, from advice, experience, and observation, seems to me all that can be done to insure our safety. No deviation from these instructions should be permitted. Latitude of action should not be given to a relief party, who on a known coast are searching for men who know their plans and orders.*"*

This, the last paragraph of his letter to the Chief Signal Officer, which I have quoted in full, is very significant, and sufficiently explicit not to admit of any misapprehension. Greely also stated plainly that the vessel "*should not leave Smith Sound, near Cape Sabine, before September 15th.*" † At first the proposition to leave a party furnished with telescopes at Lifeboat Cove to watch the shore opposite, appears quite feasible until we come to consider the peculiar conditions of the atmosphere in the Arctic regions. If Greely had been an experienced Arctic traveller he would probably have devised some other plan; for, sometimes it is impossible for several weeks in succession to get a glimpse of the coast of Ellesmere Land from the shore opposite. When the Polaris was beached on the 15th of October, 1872, the peaks of the coast to the westward were plainly in sight; but from that time until the morning of February 9, 1873, they were completely hidden from view.

During the winter following the return of the Proteus from Lady Franklin Bay, a lively correspondence was carried on between the Chief Signal Officer and different parties, both here and in Europe, concerning the necessary supplies asked for by Greely in his various memoranda and dispatches.‡

On May 6, 1882, a board of three officers, none of whom had ever had any Arctic experience, met at the office of the Chief Signal

* Signal Service Notes, No. 10, p. 23. † *Loc. cit.*, p. 23.

‡ Appendix, p. 34 *et seq.*

Officer to consider the whole subject of the supply expeditions for Lady Franklin Bay, and also for Point Barrow, on the north coast of Alaska.* Two days later the Chief Signal Officer addressed the Secretary of War, stating that it was imperative to send at once an agent to St. Johns, Newfoundland, in order to charter a steamer of proper character; to employ an ice-master to be ready by July 1 to proceed to Lady Franklin Bay, with the outfit for the international Arctic station; and during the passage of the vessel to the north to obtain at some of the Danish colonies in Greenland those supplies needed by Lieutenant Greely, which could not elsewhere be procured. The Chief Signal Officer expressed the desire to send his personal secretary, Mr. Wm. M. Beebe, then a private in general service, and formerly an officer of merit on his staff during the war.† He also requested that the Secretary of the Navy should detail a naval officer, as had been done in 1881, to be ordered to St. Johns to assist Mr. Beebe in selecting a suitable vessel. On the 13th of May the Chief of the Bureau of Navigation ordered a Commander of the Navy to proceed to St. Johns, and, if necessary, also to Havre de Grace, to select a steam-sealer under instructions of the Chief Signal Officer of the Army.‡ Mr. Beebe had received his orders as early as May 8,§ but on the 12th of the same month Congress had not yet made the necessary provisions to fit out an expedition. The Chief Signal Officer was then absent at St. Louis, and James W. Powell, Captain, 6th Infantry, was acting in his place at the time. On the 12th of May he requested the Secretary of War to call the special attention of Congress to the fact that unless an appropriation was speedily made it would be impossible either to purchase the necessary supplies or to engage a suitable vessel to transport them, as sections 3679 and 3732 of the Revised Statutes forbade the execution of any contracts in advance of specific appropriation acts.‖ On the same day Capt. Powell telegraphed to his chief at St. Louis that the Secretary of War determined that no contracts should be made for the relief expedition until the appropriation bill had passed. He informed him also that Mr. Beebe would leave for Newfoundland "next Tuesday," which, according to the almanac, was May 16.¶ On the 25th Mr. Beebe reported his safe arrival at St. Johns to General Hazen,** in a somewhat confused telegram, in which he said: "Last whaler leaves to-day,

*Special Order No. 53, Appendix, p. 39.
† Appendix, p. 40.
‡ Appendix, p. 41.
§ Appendix, same page.
‖ Appendix, p. 42, No. 49.
¶ Appendix, p. 42, No. 50.
** Appendix, p. 48, No. 56.

and will not go direct to Greenland." According to Commander S. D. Greene's statement,* there were still five suitable vessels at St. Johns on the 27th of May, viz., the Proteus, the Neptune, the Bear, the Ranger, and the Hector. The Neptune was finally selected and chartered, and left on the 8th of July, under the command of a skipper named Sopp. Mr. Beebe, who meanwhile in the correspondence had been styled Major,† turned over the "instructions regarding observations to be taken on the voyage" to the said skipper; "but, as the instruments intended for this purpose could not be found, and as Captain Sopp evidently did not understand the nature of the observations ordered," Major Beebe transferred the duty to Private Joseph Palmart, Signal Corps, U. S. Army.‡ The only officer on board the Neptune was Dr. F. H. Hoadley, Acting Assistant Surgeon, U. S. A.

After having stopped at Disco, which place was reached on the 17th of July, the vessel on the 20th proceeded on her northward course. The season was evidently not an open one, and the weather was unfavorable. She passed Wolstenholme Island at eight o'clock on the morning of the 28th, and the Cary group at about seven in the evening. At 3.30 on the morning of the following day Littleton Island was passed, and the Neptune was fairly in Smith Sound. Half an hour later Major Beebe was called by the skipper, who informed him that it was impossible to proceed any farther. "Going at once on deck" (the Major says), "I found an unbroken ice-barrier, from twelve to twenty feet thick, extending from Cape Inglefield on the west across the sound to Rosse Bay and to the northern horizon, effectually checking our further progress."§ The vessel was therefore turned southward and found a good anchorage in Pandora Harbor. On August 7th, at 10.45, she resumed her northward course, soon encountering heavy ice; and on the morning of the 9th she was fairly beset, twelve miles from Victoria Head. During the next day she drifted a short distance to the northward, and then reached latitude 79°20 N., which may be called her highest latitude. On the 15th she was finally liberated and stood across the sound to the eastern shore; then she turned to the westward and came to anchor at Payer Harbor on the morning of the 18th. Subsequently the English depot was visited and found in good condition, with the exception of some casks of rum and wine which had been broken by bears. The cache was rebuilt and made as secure as possible.

* Appendix, p. 50, No. 59.

† Appendix, p. 43, note following No. 53, also p. 51, No. 60.

‡ Signal Service Notes, No. V., p. 5.

§ *Loc. cit.*, p. 7.

During the 21st and 22d small quantities of ice passed down the strait, and although a visit to the summit of Cape Sabine did not afford much encouragement, the vessel started to the northward at 1.30 P. M. on the 23d. North of Cape Sabine the coast was actually blocked; more to the eastward, however, some open water was found, through which the vessel worked her way in mid-channel till she was about due east of Cape Prescott; thence the ice extended to the northward as far as the eye could reach, stretching from shore to shore. Following the edge of the solid pack to the westward, she neared Cape Sabine, but the entrance of Payer Harbor was blockaded. The ship was then headed for Littleton Island and entered Pandora Harbor, where she remained till 3 o'clock on the afternoon of the 25th. In vain she now tried to penetrate north; after several desperate efforts she had to be moored to a floe. On the following day she made some northing, but, forty miles from Cape Hawks her progress was again checked by the pack. The ice was piled up in "huge, irregular rifts, impassable, even had they been stationary, by the trained seal-hunters who composed the crew; the idea of landing the stores by means of a sledge and boats was therefore abandoned."* On the 27th she proceeded some distance in a northerly direction, again reaching a position off Bache Island, but not nearer to the shore than before. The wind freshening from the northwest, the ship was made fast to a floe to wait for an opening. Notwithstanding the direction of the wind, the larger fields, many miles in extent, moved westward against it; when coming in contact with the shore, their course was changed to the southward until checked again by Cape Sabine and Brevoort Island. As all the ice in Smith Sound seemed to drift south in a body, it was determined to stand across once more to the eastward with a faint hope that an open lead might be found; but the result was the same as before. On the 28th the vessel therefore turned southward, anchoring off Littleton Island at 7.45 P. M. After the wind had abated, a party went on shore to select a place for a depot, but their presence was soon discovered by some Eskimos from Cape Ohlsen, and they therefore decided to postpone cacheing the provisions and stores till nightfall. They again stood across the sound, and at one o'clock on the morning of the 31st finally succeeded in effecting a landing and establishing a cache at Cape Sabine. The stores and whaleboat were placed in a sheltered spot, well secured and covered by a tarpaulin; and a tripod of scantling, with an oar

* Signal Service Notes, No. V., p. 9.

attached, to which pieces of canvas were nailed, was set up on the most prominent point close by. They then took refuge under the lee of Cape Ohlsen, as a heavy northeast gale was setting in. The gale continued unabated during the 1st, but at noon on the 2d of September they were able to leave their anchorage for a final effort to get farther north. Off Cape Sabine the same heavy ice-fields were encountered, and at eight in the evening the vessel had to be moored to a floe, where she remained till the 4th. Winter had now fairly set in and the young ice had increased to a thickness of four inches; the engineer reported a leak in the boiler; it therefore became necessary to return and establish a depot at Littleton Island without delay. The Eskimos still remaining on Cape Ohlsen, the stores were landed in a bight at the north end of the island, and were well concealed, while copies of records, with directions for finding the cache, were left at those points fixed upon by Greely the year previous. This being done, the last whaleboat was taken to Cape Isabella and its location marked by a tripod similar to the one on Cape Sabine.

At 11.40 on the evening of the 4th of September the vessel began her homeward voyage, and, after several stoppages, she reached St. Johns on the 14th of the same month.

Greely, foreseeing that the vessel he expected to be despatched in 1882 might probably not reach Lady Franklin Bay during the same season, requested the Chief Signal Officer, as has been previously stated, to send in the course of the following year a capable, energetic officer with ten men, eight of whom should have had practical sea experience, provided with three whaleboats and ample provisions for forty persons to last fifteen months, to effect his rescue. In consequence of this request, General Hazen, on the 27th of October, 1882, applied to the Commanding General, Department of Dakota, through the Adjutant-General of the War Department, "to select without delay an officer to take charge of half a dozen men to compose an expedition to proceed next spring to Lady Franklin Bay, as relief to the Greely Arctic party."* Ernest A. Garlington, Lieutenant, 7th Cavalry, having meanwhile volunteered to command the expedition, the Chief Signal Officer on the 13th of January, 1883, requested the Adjutant-General to direct him to report in person† at Washington. On the 20th of February the young officer arrived, and on the 28th of the same month Captain William H. Clapp, 16th Infantry, the chief

*Appendix, No. 116, p. 88. †Appendix, No. 125, p. 93.

Arctic expert of the Signal Office, received a memorandum to the effect that he should give to Garlington the necessary information regarding the station at Lady Franklin Bay,* which request was complied with on the same day.

The preparations to fit out the expedition were at once commenced, and an Act of Congress, approved March 3d, provided for the completion of the work and made the regular annual appropriation of twenty-five thousand dollars. On May 10 General Hazen applied to the Secretary of War, asking for authority to proceed to St. Johns, in order to secure the best vessel available for the purpose;† ten days later he received orders to that effect. Subsequently the steamer Proteus, which had conveyed the Greely party to Lady Franklin Bay in 1881, was chartered. At the request of the War Department the Secretary of War ordered the United States Steamer Yantic to act as tender to the Proteus, and Garlington with his men left New York on board the former vessel, commanded by Commander Frank Wildes, for St. Johns, Newfoundland, where they arrived on the 21st of June. While in St. Johns, Lieutenant J. C. Colwell, U. S. N., was at his own request detailed for duty to join the expedition, and reported to Garlington on the 23d of June. In the course of the afternoon of the 29th both vessels left the harbor for Disco Island, the Proteus once more in charge of her former skipper, Captain Pike.

Lieutenant Garlington had received his orders from the War Department on the 4th of June, and those of Commander Wildes are dated Navy Department, June 9. The Chief Officer very strongly urges the young Lieutenant of cavalry to spare no effort in pushing his vessel through to Lady Franklin Bay, as Greely with his party, unless reached by the relief ship, would have *to retreat southward by land* (!), and would thereby have to undergo great hardship and, perhaps, be compelled to abandon much valuable public property, with possible loss of important records and life. In case the vessel should be unable to reach her destination, Garlington was directed to land his party and stores at or near Lifeboat Cove, to discharge the ship with orders to return to Newfoundland, and to stay until relieved the following year. He should endeavor to communicate with Greely by taking personal charge of a party of the most experienced and hardy men, equipped for sledging, carrying such stores as would be practicable to Cape Sabine, where a smaller party, more lightly equipped, still

* Appendix, No. 136, p. 99. † Appendix, No. 159, p. 113.

headed by himself, was to push as far north as possible or until the missing party were met.

The preceding paragraph embodies the substance of his instructions as given and signed by W. B. Hazen, Brig. and Bvt. Maj. Gen'l, Chief Signal Officer, U. S. A.*

The orders issued to Commander Wildes read to the effect, that in view of the possibility of the destruction of the Proteus, he should proceed as far north as practicable, to afford succor to her officers and men, in the event of such an accident, and that it was desired that he should await there the return of that ship, or the arrival of authentic information as to her fate. He should under no circumstances proceed beyond Littleton Island or enter the pack. The length of his stay to the northward of Upernivik was to depend upon his own discretion, and in case it should be imperative to leave the vicinity of Littleton Island or Cape York before the return of the Proteus, he was to establish a station on shore, having first settled with Lieutenant Garlington upon prominent points in Smith Sound or Baffin Bay in which to deposit information as to his movements.†

The agreement between Lieutenant Garlington, U. S. A., and Commander Wildes, U. S. N., was made in the shape of a memorandum, and reads as follows:

"Yantic will proceed to sea with Proteus and remain in company as long as possible. Yantic will proceed to Disco under sail. Will leave letters for Lieutenant Garlington at Disco and Upernavik. Cairns enclosing bottles or tins will be left at Cape York, NW. Cary Island, or Hakluyt Island, Pandora Harbor, and Littleton Island. Yantic will remain in Pandora Harbor not later than August 25th; Disco not later than Sept. 20th.

"Lieutenant Garlington to leave letters in Disco and Upernavik, and records on NW. Cary Island or Hakluyt Island, Littleton Island, and Pandora Harbor, if entered.

"Proteus to endeavor to communicate with Yantic at Pandora Harbor before August 25th.

"Should Proteus be lost, push a boat or party south to Yantic.

"Pandora Harbor will be headquarters, but before departure, Yantic will run up to Littleton Island."‡

The Proteus reached Goodhaven on the 6th of July and the Yantic on the 12th. As the latter vessel had to repair her boilers, the repairs causing

*Signal Service Notes, No. X., pp. 21, 22.

†Appendix, No. 241, p. 175. ‡Appendix, p. 117.

six days detention, the Proteus on the morning of the 16th* weighed anchor to proceed north and to procure a native dog-driver at a small settlement on Disco Fjord, on which occasion she ran foul of a rock, but was easily gotten off, without having suffered more damage than the breaking of her main injection pipe. On the morning of the 17th Hare Island was passed about 40 miles to the eastward, and at 6.20 P. M. Saunderson's Hope was sighted from a distance of some 50 miles. At 4.30 A. M. on the 19th the vessel had to stop on account of a heavy ice-pack; she was backed and put on a southerly course for about eight miles; then she steered to the eastward, and a little past seven high land was sighted. Up to this time it had been impossible to get observations; now a short stop was made on the edge of the pack to obtain sights for time, which placed the vessel in longitude 61° 30′ W. Captain Pike had pronounced the eastern land to be Cape York, while in reality it was Cape Walker. Unfortunately the data relating to geographical positions are very meagre in the official report of Lieutenant Garlington, and we find the same to be the case in consulting the log of the Proteus, s sent by cable from St. Johns to the New York *Herald* on Septer ber 17, although the article fills over two columns. On the track-chart, prepared under the direction of the Chief Signal Officer of the Army, accompanying "Signal Service Notes No. X.," the track of the vessel only begins at a point in about latitude 74° N., longitude 64° W., and continues due north to about latitude 76° N.; and it is not easy to make the graphic representation agree with the statements in Garlington's report as far as the passage through Melville Bay is concerned. After steering various intricate courses, Cape York finally came in sight during the afternoon of the 20th of July; at seven in the evening Conical rock was sighted, and six hours later it was passed, while the vessel was among loose ice. Towards midnight of the 21st the Proteus was stopped by close pack. At noon the following day she had cleared the ice, and subsequently the depot of the Nares expedition on the Cary group was visited and found to be undisturbed. According to Garlington's statement, about sixty per cent. of the provisions were in good condition, while perhaps seventy-five per cent. could be used in an emergency. After a record for the Commander of the Yantic had

*In comparing the report of Lieutenant Garlington with that of Commander Wildes we find a conflicting statement as to the time the Proteus sailed, Wildes' date being earlier by one day. See Signal Service Notes X., p. 5, and Appendix, No. 247, p. 178.

been left, the vessel steamed through open water, shaping her course to Cape Alexander. At 6 A. M. on the 22d the cape was doubled, and shortly afterwards she entered Pandora Harbor, where another document was deposited. There was no ice visible to the northward, not even from the crow's-nest. Garlington therefore determined not to stop at Littleton Island, but to push on to Cape Prescott, where he intended to establish his first cache and to leave a whaleboat. Littleton Island was passed shortly before ten in the morning, and the sea was still free from ice; but, half an hour later the lookout reported ice in sight, and towards noon the vessel was stopped by an apparently unbroken barrier, stretching from shore to shore and closing up the sound. Garlington then decided to proceed to Cape Sabine in order to examine the stores deposited there, and to leave records, and there to await further developments. Payer Harbor was reached at half-past three in the afternoon, and two privates were landed for the purpose of making magnetic and other observations. Garlington in person searched for the depot of provisions, which after some difficulty was eventually found; everything was in good condition except the boat, which had been slightly damaged by bears. While the men were at work he "examined the condition of the ice to the northward and discovered," as he states in his official report, "that the pack had broken, and that open lanes of water had formed, leading across Buchanan Strait, along Bache Island, and across Princess Marie Bay as far north as a point of land, which I took to be Cape Hawks, and around it. After satisfying myself with the glass that there could be no mistake about the presence of a favorable lead, I started back to the ship, hurrying as rapidly as possible, appreciating the rapid changes in the condition of the ice and the treacherous movement of the pack. I reached the ship at 6.30 P. M. and at once got the observers aboard, and told Captain Pike of the open way, and requested him to get under way and steam out of the harbor to make an examination of the leads and an effort to proceed north."*

Garlington, like a brave soldier, now availed himself of the first opportunity to carry out his orders and "*to push the vessel through to Lady Franklin Bay.*"† The master of the Proteus was opposed to proceeding farther north until the sound should be more clear of ice. It was still early in the season, and Smith Sound was scarcely navigable. But finally he was overruled by Garlington, whose orders had to be obeyed, and they weighed anchor. "In fifteen minutes

* Signal Service Notes No. X., p. 8. †*Loc. cit.*, p. 21.

after leaving the harbor," according to Captain Pike's statement, "the ice was met, and the Proteus continued butting it until 3 P. M. next day, when she was jammed. At 7 P. M. she sank."*

Garlington, according to his own statement, requested Lieutenant Colwell to take station in the crow's-nest with the mate of the vessel, when Cape Sabine was doubled. His official report to the Chief Signal Officer contains the following passage relating to the movements of the vessel after having weighed anchor:

"We proceeded through the open leads in the broken ice, which was very heavy, to within four miles of Cape Albert, when the ship was stopped about six hundred yards from open water, which extended along the coast as far as could be seen from the 'crow's-nest.' Captain Pike thought the ship could be forced through, and entered a crack in the ice, and we accomplished about half the distance by 'ramming.' But after this the 'ramming' was ineffectual, as the fragments of ice about the ship had become ground up so fine that when she backed out, it would fill up the space immediately in front of the new fracture in the ice, and, as the ship came forward to ram, it acted as a cushion, which reduced her momentum to such an extent that when she struck the ice itself she had not sufficient force remaining to have any effect upon it. About midnight the attempt at this point was given up. A lead was found more to the eastward, in which the ship made fair progress until 2 A. M. the 23d, when we were jammed and unable to move in any direction within two hundred yards of open water. The ice here was not so heavy as it was in the position left at midnight, and Captain Pike pronounced the ship in no danger, on account of its yielding nature. Soon after, at 5 A. M., the ice immediately in front separated, and we were in the open water, which had been in our immediate front the night before. On

**Evening Mercury*, St. Johns, Newfoundland, Sept. 21, 1883, p. 2.

On the 27th of December Captain Pike stated before the Court of Inquiry, convened at Washington, D. C., pursuant to General Order No. 249, of the War Department, as follows: "We entered Payer Harbor, I think, about 5 o'clock, and anchored, and about 7 o'clock Lieutenant Garlington came on board. I was lying in my bed, and he came to the stateroom door and called me and told me he could see open water away north towards Cape Hawk. I told him I didn't think it was any good and that I was not ready to go; I wanted to get some fresh water and fill my bunkers. I also told him I was anxious to get north as he was. He says, 'I can see open water, and I want to go,' and said, 'You shall have my men to help fill your bunkers.' I said I would go, and we left there about 7 o'clock in the evening, or half-past seven."

arriving within four miles of Cape Albert it was discovered that the open lane of water seen the night before had disappeared, and that the solid pack now held its place."

Were I treating this as a mathematical problem, I should give the greatest weight to the judgment of Captain Pike; the next weight would have to be given to the opinion of Lieutenant Colwell, who, at the time, was in the crow's-nest; and I should give the least weight to the opinion of Lieutenant Garlington. To battle successfully the ice in the Arctic seas is somewhat different from leading a dashing cavalry charge, and, similarly, the anatomy of a horse is somewhat different from that of a vessel. Besides, we can hardly expect a young lieutenant who has distinguished himself on the plains, to have the experience of an ice-master, grown gray in the service. The Proteus is now at the bottom of the sea, and all the arguments I could offer would not be able to raise her, or to relieve the ice-bound party in Lady Franklin Bay. The person responsible for the disaster is the Chief Signal Officer, who had sent a young lieutenant of cavalry on a mission that ought to have been entrusted to an experienced Arctic explorer. In 1882 he sent an individual who was not sober during the voyage as long as the liquor lasted; and, according to the statements published in the leading newspapers, the same person would have again been detailed if steps had not been taken to prevent it. If the Chief Signal Officer was determined to follow Greely's instructions and send an officer of the service, why did he not select Captain Clapp, who had given considerable study to Arctic explorations, and who had volunteered to go and take charge of the party? Captain Clapp had officially requested the Chief Signal Officer to send him, and for a time was hopeful of going; but to his request he never received any reply, either written or verbal.* The Chief Signal Officer evidently treated the whole matter with too much indifference, and his ideas as to the safety of Greely and his command seem to have undergone considerable change in a very short time, as may readily be inferred from the official documents published in the Appendix of his Report.† In his Annual Report to the Secretary of War, for the year 1883, we read the following passage: "*If the 'Proteus' shall not reach Lady Franklin Bay, an application will be necessary for another expedition to sail in 1884, for, no special appropriation had been made*

* See Captain Clapp's letter, dated Camp Pinery, near Fort Davis, Texas, December 1st, 1883.—Proceedings of the Court of Inquiry, pp. 181–83.

† In Appendix, p. 82, No. 110; p. 88, No. 117; p. 118, No. 175.

by Congress except for the expedition that sailed in 1883." The date of his report is October 15, 1883; the loss of the vessel was telegraphed from St. Johns on the 13th of September, and Garlington reached Washington on the 1st of October, and reported at the office of the Chief Signal Officer for duty. It is true that the report is for the fiscal year which ends June 30; but extraordinary circumstances require extraordinary measures.

The idea expressed by General Hazen that Greely and his party would have to retreat overland in case of emergency is certainly a very peculiar one, and it clearly shows that those who wrote Garlington's orders were utterly ignorant of the nature and character of the country to be traversed. The orders were evidently written by a soldier; and in Arctic exploration, as in warfare, the topography of the country to be passed over is of primary importance.

In 1728 the Danish government sent Major Paars and Captain Landorff to West Greenland, in charge of a company of soldiers, with horses and artillery-pieces, and with orders to cross to the ice-bound east coast to establish a fort.* The two officers named had proposed to traverse the country on horseback, but the horses died during the passage and the artillery was then rendered useless. When the party became acquainted with the true character of Greenland, they noticed at once what a ludicrous and madcap scheme they had advocated. This happened more than one hundred and fifty years ago, when very little about the topography of Greenland was known. To-day we can only smile at such an attempt.

But let us now return to the wrecked crew of the Proteus. Lieutenant Garlington with his men had been helping to take stores on deck after the vessel had been nipped, and had the provisions and most of the instruments of the expedition placed on the ice. Lieutenant Colwell, having stuck to the Proteus till the very last, succeeded in landing some of the stores about three miles west of Cape Sabine, and secured them as well as circumstances permitted. This cache consisted of hard bread, of tea and bacon, of canned goods, sleeping-bags, and tobacco. It was estimated at five hundred rations. Soon after Lieutenant Colwell had started for Cape Sabine, Lieutenant Garlington followed him; but the passage was very tedious; he had only two men who were familiar with the use of oars, and the boat was almost swamped. At noon of the 24th of July the whole party was

* See Robert Brown, Arctic Papers, p. 6.

on shore at Cape Sabine with about forty days' rations. They cached a large quantity of clothing, and left soon after three o'clock in the afternoon of the following day, to open communication with the Yantic, or perhaps with the Swedish steamer Sofia. In crossing the sound, the boats were separated during a fog. Garlington with his two boats remained over night near Lifeboat Cove, and early the next morning reached Pandora Harbor, where he found Captain Pike with the rest of the party. Proceeding south, they made land on the evening of the 8th of August about fourteen miles north of Cape York; shortly afterwards, the ice was closely packed. Lieutenant Colwell, with orders to proceed south, left in a boat manned by volunteers early in the morning of the following day, to communicate with the Eskimos at Cape York. Towards midnight, after the ice had opened, the rest of the party also started. When eight miles from Cape York, their attention was attracted by the report of a rifle fired on shore. They immediately steered for the point whence the sound had proceeded, and in a few minutes reached Colwell's camp. Through the interpreter he had ascertained from the natives that as yet no vessel had passed. The Yantic had left Upernivik only at noon on the 31st of July, and did not sight Cape York until one o'clock in the morning of the 20th of August. Towards ten in the evening she reached the Cary Islands and found Garlington's record. She left an hour afterwards with no ice in sight, and passed Hakluyt Island at two o'clock the following morning. Commander Wildes then steered for Cape Alexander, where he arrived at one o'clock in the afternoon, finding the ice closely packed against the land, while there was some open water on the opposite shore. At Littleton Island he picked up another record of Garlington from a small cairn in which he deposited some documents relating to the course of the vessel, and at 10 P. M. he was at anchor in Pandora Harbor, where two more cairns were discovered: one, from Captain Pike, with news that the party were proceeding south, hoping to meet the Yantic; the other, from Lieutenant Garlington, stating that he had arrived at Pandora Harbor on the 26th of July. Commander Wildes at once got under way and, passing Cape Alexander, steered down the coast to Cape Robertson within a mile of the beach, looking out for cairns or other traces of the Proteus men. Nothing was seen, however, and, passing Cape Robertson, he ran across the mouth of Murchison Sound and skirted the shore of Northumberland Island. Then he stood across to Hakluyt Island, which was closely examined, and after-

wards he searched the cairns of the Cary group. Unwilling to leave without obtaining news from the missing party, Wildes returned to Hakluyt Island, the SE. point of which was passed August 5, and stood across Whale Sound. At a low point two miles east of Cape Parry he deposited a record and then proceeded to the south. In the evening of the next day the Yantic anchored at Northumberland Island, where the parties sent on shore discovered two broken-up camps, only a few days old. Commander Wildes, feeling certain that the crew of the Proteus had proceeded south, concluded to follow the same course as soon as the condition of the ice would permit. After having erected a cairn in which he deposited a record, he left at 3 P. M. on the 9th of August, and stood southward to continue the search. In the evening, the pack, extending in a northwesterly and southeasterly direction, was reached. The vessel was headed for Cape York, and after several detentions, caused by ice and thick weather, finally anchored at Upernivik on the 12th. Shortly afterwards, the commander of the Yantic chartered a launch from the chief trader of the settlement, and dispatched it to Tassiussak with fifteen days' rations for thirty-seven men. He remained at Upernivik till the 24th and proceeded to Waigat, where he spent four days in coaling, making Disco on the 28th. Early on the morning of the last day of August a native arrived in a kajak with a letter from Lieutenant Colwell, and shortly afterwards Colwell himself came with six men and an Eskimo. Colwell had reached Upernivik only a few hours after the vessel had sailed; he stopped merely long enough to dry his clothing and to embark in a launch, when he started for Disco. He had been in an open boat for thirty-nine days, and under great hardships and privations had travelled some 900 miles. Having separated from the other boats at Cape York, he took the first open lead in a southeasterly direction, intending to steer to Upernivik; but he was hardly under way when a westerly gale set in, before which he had to run for about twenty hours. This was immediately followed by another gale from the southeast, which was ridden out under the lee of an iceberg. Even under the most trying circumstances his crew showed unfailing courage, and were always in readiness to comply with any call of their commander, who displayed more than ordinary energy, courage, and professional skill.

Thinking that the other boats had reached Upernivik, Commander Wildes proceeded there on the afternoon of the same day, and on the 2d of September had the gratification of welcoming the whole party

on board his vessel. Although somewhat thin and weather-beaten, they were all in good health, with the exception of the surgeon, who suffered from sore feet. Near Cape Shackleton, Lieutenant Garlington had met a number of Eskimos in a whaleboat, who gave him some hard bread and coffee. The man in charge of the boat was from Upernivik; he understood a little English, and informed Garlington that he had been ordered to look out for him and his party, and that Wildes had sent stores to Tassiussak. They all proceeded to the latter place, where they arrived in the afternoon of the 23d of August. A letter from Commander Wildes, written at Upernivik ten days before, stated that he would remain there as long as he considered it prudent, and would then proceed to the coal mine near Disco. Subsequently the party set sail for Upernivik, although Captain Pike's men insisted upon making a halt; they reached that settlement in the course of the forenoon of the following day, and were most kindly received by the hospitable Danes; the officers were invited to live at their dwellings, while the chief trader of the post had cleared a comfortable storehouse, belonging to the Danish Company, to serve as quarters for the men. Here Garlington also received some news about Colwell, and learned that he had left on one of the launches belonging to the company. A letter left by Wildes informed him that he considered it "a serious risk to keep the vessel in this high latitude," and that he would "remain at Godhaven until about September 15th, not later, and then proceed home." *

Garlington had decided to await news from the Yantic at Upernivik, t[illegible]nter there in case she should fail to return, and to make a sledge journey to Cape York. This proves that Garlington could not have been familiar with the condition of the ice in Melville Bay. Eskimo Hans, who had deserted Kane's vessel, although thoroughly homesick and well acquainted with most of the northern Danish settlements in Greenland, did not even attempt to start south, but patiently awaited the appearance of a vessel, and after years of longing was finally rescued by Hayes.

The mistake had been made; the Proteus had gone down, and there was evidently nothing to be done but to return home. On the 13th of September the Yantic reached St. Johns, Newfoundland, and arrived at New York on the 29th of the same month.

Serious charges have been made by various parties against Lieutenant Garlington and Commander Wildes. But it must be remem-

* Signal Service Notes, No. X., p. 17.

bered that the Yantic was not built to encounter heavy ice or to enter the Arctic pack; and her commander would therefore not have been justified in taking any more risks than he did; had he done so, we might now have to deplore the loss of two vessels instead of one. If the Proteus had waited in Payer Harbor for a week or ten days, Smith Sound would probably have been more open, and she might have passed with impunity the critical place where the Neptune was beset the year before, and where, a short distance to the south, she herself was nipped and lost.

The two officers above-named have certainly tried to fulfil their mission to the best of their knowledge and ability. A Newfoundland sealer or a whaling vessel of the fleet, built for the purpose, might easily have stayed in Smith Sound till the 15th of September, as requested by Greely in one of his memoranda sent back to the Chief Signal Officer from Camp Conger after the party had been landed. But the Yantic could not do so, and the disaster that happened to the Proteus could not be foreseen, and would certainly not have happened had Garlington not ordered her skipper to plunge headlong into the ice. The answer he received from Captain Pike, when he ordered him to go ahead, that "the coal-bunkers of the vessel were not filled," may be considered as a mere pretext, because the experienced sailor hesitated to go and wished to await a more favorable opportunity in order to proceed north. Garlington, as mentioned before, acted like a brave cavalryman and tried to obey strictly his orders, and "*to push the vessel through to Lady Franklin Bay.*" He attempted to carry out these orders and wholly disregarded his so-called "supplementary instructions," so often spoken of lately, and which were found by him enclosed in an envelope that contained his actual instructions. He had considered these supplementary instructions to be merely an authenticated copy of a memorandum prepared in the office of the Chief Signal Officer for the Secretary of the Navy, and to be simply the basis of instructions to be given to the commander of the vessel ordered to accompany the Proteus. Garlington at once carried the document to the Chief Signal Officer and called his attention to the clause relating to land stores and supplies on Littleton Island. The Chief Signal Officer said that he did not know how the document had found its way into the envelope containing Garlington's orders, and impressed him with the necessity of simply carrying out those orders properly addressed to him.

The main paragraph of the supplemental orders reads as follows:

"*The Proteus is to land her stores, except supplies for more northerly depots, at Littleton Island on her way north. If she succeeds in reaching Lady Franklin Bay, she is to pick up the stores, excepting the house and depots, if possible, on her return.*"

If this paragraph had been incorporated in the *orders* and *instructions* officially sent to Garlington, much anxiety and sorrow would have been spared those interested in the welfare of the party, and in Arctic exploration in general.

The position of Greely and his party is not a dangerous one, although it is critical. He probably has provisions sufficient to last until the autumn of 1884, without taking the fourteen musk-oxen into consideration; these, according to his own statement, would provide him and his men with meat for seven months, even though issued as often as three times a week. Captain John Ross, not as well equipped as he is, spent four consecutive years in the Arctic regions, and still made good his retreat; but at the same time we must not forget that he wintered in lower latitudes, where the sun is not so long below the horizon as in Lady Franklin Bay. The news received from the Cape York Eskimos by the Swedish steamer Sofia, that, according to the statement of the Eskimo Hans, one of the members of the Greely party had been killed, ought not to be credited. These people are fond of telling stories in order to make themselves interesting. If the two natives in Greely's employ had actually come south from Lady Franklin Bay, they would either have been the bearers of despatches which they would have deposited in the various cairns erected by the party, or they would have returned to one of the Danish settlements. There exists another version of the story to the effect that some white men had come from Lady Franklin Bay to Littleton Island, who are said to have informed the natives of a similar occurrence. As far as I am aware, there was no white man with Greely who was familiar with the language of the Eskimos, and the Eskimo language is not easily acquired; if these white men had reached the mouth of Smith Sound, they would certainly have visited some of the depots and would have tried to get on board of one of the whalers.

I consider it probable that Greely with his party did not leave Lady Franklin Bay after the vessel had failed to reach them. In the course of time they evidently learned how difficult it would be to make a sledge-journey to Littleton Island from Fort Conger. They

had certainly become acquainted with the character of the ice of Smith Sound after they had set out on their autumn travels; and, after having spent a few days only at their wintering place, they would have learned that a retreat overland as mentioned by the Chief Signal Officer would be an impossibility.

If Greely had attempted to retreat, he could have fallen back on the various depots established by the English Expedition, by himself, and by the two relief expeditions sent out in 1882 and 1883. Major H. W. Feilden, H. B. M. A., who had highly distinguished himself as naturalist of the Alert, under Sir George Nares, says, in a letter to me, dated Wells, Norfolk, November 5th, 1883: "I have no doubt that the United States Government with its usual energy and munificence will organize relief next year on an efficient scale." He is of the same opinion as myself that Greely had not left Lady Franklin Bay; but he takes a less favorable view of the case, not knowing that the party is provided with stores sufficient to last them till the autumn of 1884. Major Feilden, assuming the party to be still ice-bound, proposes to have a relief-expedition sent out next year, consisting of two steamers, and continues: "The coast-line from the Devil's Thumb to Cape York should be searched in case the Eskimo report be true that Greely's party reached Littleton Island and attempted to get south. The search should be carried along carefully from Cape York to Littleton Island. Supposing that one steamer did that, the other might go on to Pandora Harbor or Port Foulke. Premising that both our ships are at Port Foulke in the beginning of August, I would suggest that they move across the Sound to Payer Harbor; one, to remain there, the other, to be ready to take advantage of any clearance in the ice so as to make a rush up to Discovery Bay. Supposing that this proves impossible, then I am afraid the fate of Greely's party would be sealed; the winter of 1884–85 would be beyond hope. Still, it would be incumbent to recover the records and to see to the fate of the Discovery Bay party. To this end (the necessity I trust may never come to pass) one ship should be left to winter in Payer Harbor and from thence push sledge-parties to Discovery Bay in the spring of 1885. The escape of a steamer from Payer Harbor in 1885 is almost a certainty."

So far Major Feilden, whose opinion is of great weight. Personally I feel inclined to take a more favorable view of the case, and do not hesitate to express the hope that Greely, towards the end of June, will be near Littleton Island. But at the same time I will

not omit mentioning that a party who has spent three winters in the latitude of Fort Conger is probably not over fresh. The sick ones will have to be cared for and will have to be conveyed south, and there will be other drawbacks; the bad condition of the ice, the stormy days necessarily to be expected, and the low temperatures necessarily to be encountered. Although I consider it more prudent to send two vessels, one would be sufficient to relieve the little band. A staunch steamer, built for ice navigation, and well equipped, provided with dogs, sledges, and the other necessaries for an Arctic campaign, and provisioned for two years, should leave the United States early enough to reach the edge of the pack in Melville Bay about the middle of June, or perhaps earlier, so as to be ready to take advantage of an unusually open season. She should search the vicinity for traces of the missing party, and then proceed northward, perhaps to Littleton Island, Port Foulke, and then to Payer Harbor. She should carry an additional number of whaleboats; for, if Greely should not have come south, a boat journey to Fort Conger could be made much more easily than a cruise in a vessel. It would be advisable to procure some Umiaks at the Danish settlements in West Greenland, for an Umiak is very portable. These boats are flat-bottomed, from 25 to 37 feet long, about 2½ feet deep, and 5 feet beam, and in bad weather they almost equal a whaleboat, as their flexibility prevents them in some measure from shipping seas.* Laden with provisions for the voyage north, they might be taken in tow by the whaleboats, and finally be cut adrift after the provisions had been consumed; or, if possible, they might be cached on shore, near the various depots, which should be left intact for the joint retreating party. Captain W. A. Graah, of the Danish Navy, during the years 1828 and 1831, explored the ice-beleaguered east coast of Greenland to about latitude 65° N. in these boats, and, as usual, they were rowed by women, and did excellent service.

In the way of suggestions I have nothing more to offer, for the navigation of the Polar seas is uncertain, and depends solely on the favorable condition of the season and on the natural tact of the sailor. But if Government should decide to purchase one or more vessels for the relief of the Greely party, these vessels ought not to be disposed of as was the Tigress in 1873, which, after having returned from her searching expedition, was sold to her former owners at a sacrifice.

Countries comparatively poor, like Scandinavia, Germany, and

* Rink, Danish Greenland, p. 179.

Holland, own vessels especially fitted out for Arctic exploration, and the short summer voyages of these vessels have largely added to our present knowledge of the Polar seas. Why should the United States not follow the example of these countries? A private English gentleman, Mr. Leigh Smith, owned a yacht on which, at his own expense, he made yearly voyages to the Arctic regions, and to his various unpretentious cruises we owe valuable geographical discoveries. Why then should a great country like the United States not be able to do what a private individual has accomplished? why should it not follow the example of countries whose coast-line is almost microscopic, if compared with the coast-line of North America? Hydrography is the key to navigation, and navigation controls commerce and traffic, which, in their turn, regulate the welfare of nations.

The various failures and disasters we have to record in Arctic explorations during the past few years should not tend to dishearten us. On the contrary, they should intensify our interest, and increase our efforts to unveil the secrets of the Poles. Arctic exploration, like warfare, has in the course of time fairly become a science, and the danger of now wintering in high latitudes is much less than it was twenty years ago. Our resources are growing, and they do so at an almost astonishing rate. The percentage of lives lost in Arctic exploration is insignificant when compared with the mortality in the tropics or in other regions, where contagious diseases sometimes in a single day carry off more victims than death reaps in half a dozen Arctic exploring vessels during the course of years. And what a splendid school for seamanship the Polar seas afford, where the sailor has constantly to be on his guard; where ice-floes, moved by treacherous currents, may at any moment endanger and nip his vessel and send her to the bottom of the sea! Polar exploration heightens the courage of the sailor and cultivates presence of mind, thereby raising the moral standard. Nelson, the hero of Trafalgar, had seen Arctic service under Phipps during his voyage towards the North Pole in 1773, and Cochrane probably owed no small part of his naval success to his experience in the Polar regions.

The nineteenth century, with its great inventions and discoveries, is drawing to its close, and in geography a new era has commenced; but, our knowledge of the distribution of land and water in the vicinity of the Poles is almost as imperfect as it was at the time when Cook made his memorable voyage towards the South Pole, and when Forster, his scientific companion, tried to convince him that the vast ice-floes obstructing their passage were not of meteoric origin.

NOTES.

The map accompanying this paper is a photo-lithographic reproduction of the map contained in Bessels' *Amerikanische Nordpol Expedition.* Originally it showed only the tracks of the Polaris Expedition; the others were subsequently drawn in. As the sheet had to be greatly reduced, and as confusion would thereby be avoided, I omitted the tracks of those vessels that could not strictly be termed exploring vessels. The plan of Discovery Harbor, which was also added, is copied from the plate facing p. 62 of the English Blue Book, containing the account of the expedition under Sir George Nares of 1875–76.

The material of the preceding paper, which does not claim to be much more than a critical compilation, was taken from the works mentioned hereafter. I have drawn freely from the publications of the various explorers, going in some instances so far even as to use their own words, when I thought that I could attain a higher degree of accuracy. With regard to the voyage of Bylot and Baffin, I had an opportunity several years ago to consult the original manuscript in the British Museum, and I have used my notes, made at the time. Inglefield's narrative I have not been able to see in the original, as I found it impossible to purchase or otherwise obtain a copy of this work. As the compiler and editor of the voyage of the Polaris had only a few meagre journals and a log-book at his disposal, I have dwelt somewhat longer on the passage of the vessel and upon the more important incidents during the voyage; frequently I have used entire passages from my own narrative.

The works enumerated hereafter have been consulted and partly quoted. For the sake of brevity, the Appendix to the Report of the Chief Signal Officer is merely quoted as "Appendix," and the Narrative of the Polaris, edited by Admiral Davis, as "Narrative."—

Arctic Manual, prepared for the use of the Arctic Expedition in 1875, under the direction of the Arctic Committee of the Royal Society, edited by Professor T. Ruppert Jones. London, 1875.

Arctic Papers for the Expedition of 1875. London, 1875.

Bessels (Emil). The Tides at Polaris Bay. Washington, 1876.

——Scientific Results of the U. S. Arctic Expedition. Washington, 1876.

——Die Amerikanische Nordpol Expedition. Leipzig, 1879.

Beynen (L. R. Koolemans). De Reis der Pandora. Amsterdam, 1876.

Davis (C. H., Rear-Admiral, U. S. N.). Narrative of the Polaris Expedition. Washington, 1876.

Feilden (H. W.). Notes from an Arctic Journal. (Reprinted from "The Zoologist"),—no date.

Graah (W. A.). Undersögelses-Reise til Östkysten af Grönland, 1821–31. Kiöbenhavn, 1832.

Hayes (Isaac I.). The Open Polar Sea. New York, 1874. Hurd & Houghton.

——An Arctic Boat Journey in the autumn of 1854. Boston, 1860.

——Physical Observations in the Arctic Seas, reduced at the expense of the Smithsonian Institution, by Ch. A. Schott. Accepted for publication, February, 1865.

Howgate (Henry W.). Polar Colonization and Exploration. Beresford, Printer, 523 Seventh Street, Washington, D. C. (no date; probably published in 1877).

——Congress and the North Pole. An abstract of Arctic Legislation in the Congress of the U. S. Kansas City Review of Science and Industry, 1879.

——The Cruise of the Florence. Washington, D. C. James J. Chapman, 1879.

Kane (Elisha Kent, U. S. N.). The U. S. Grinnell Expedition in search of Sir John Franklin. New York, 1854.

——Arctic Explorations; the second Grinnell Expedition in search of Sir John Franklin, 1853, '54, '55. Philadelphia, 1856.

——Physical Observations in the Arctic Seas, reduced by Ch. A. Schott. Washington: Smithsonian Institution, 1859, 1860.

Markham (Albert Hastings, Captain R. N.). The Great Frozen Sea. London: 1878.

Nares (Sir G. S., Capt., R. N.). Narrative of a voyage to the Polar Sea during 1875–76 in H. M. Ships "Alert" and "Discovery." London, 1878.

——Official Report to the Lords Commissioners of the Admiralty. Nature, November 9, 1876, pp. 24–48.

Navy Department. Annual Report of the Secretary of the Navy on the operations of the Department for the year 1873. Washington, 1873.

Petermann (A.). Das Nördlichste Land der Erde. See Petermann's Geographische Mittheilungen, 1867, Heft 5, p. 176–200.

Signal Service Notes, No. V. Work of the Signal Service in the Arctic Regions. Washington, 1883.

——Notes No. X. Report on Lady Franklin Bay Expedition of 1883. Washington, 1883.

——Annual Report of the Chief Signal Officer to the Secretary of War for the fiscal year ending June 30th, 1881. Washington, D. C.

——Appendix to forthcoming Annual Report of the Chief Signal Officer. (This Appendix was printed for the use of the Proteus Court of Inquiry, pursuant to Special Order No. 249, and many quotations are taken from the advance sheets. They were paged from 1 to 242.)

Rink (Dr. Henry). Danish Greenland; its people and its products. London, 1877.

Ross (John, Captain Royal Navy). A Voyage of Discovery for the purpose of exploring Baffins Bay, and inquiry into the probability of a Northwest Passage. London, 1819.

War Department. Various printed Orders and Instructions.

Weyprecht (Karl). Die Metamorphosen des Polareises. Wien, 1879.

Young (Sir Allen, R. N. R.). The Two Voyages of the Pandora in 1875 and 1876. London, 1879.

Navy Department. Annual Report of the Secretary of the Navy on the operations of the Department for the year 1873. Washington, 1873.

Those who study the above-mentioned publications in a critical manner will probably come to the conclusion that my *Amerikanische Nordpolfahrt* contains

a number of woodcuts, evidently taken from the *Narrative*, without my stating the source from which they were derived. This, however, is not the case, as these illustrations were placed by me at the disposal of the editor of the *Narrative* and belong to me. I herewith give the pages of the illustrations as found in the *Narrative* and also as found in my own book. The pages in the upper line, in heavier type, are those of my work; those in the line below relate to the *Narrative*.

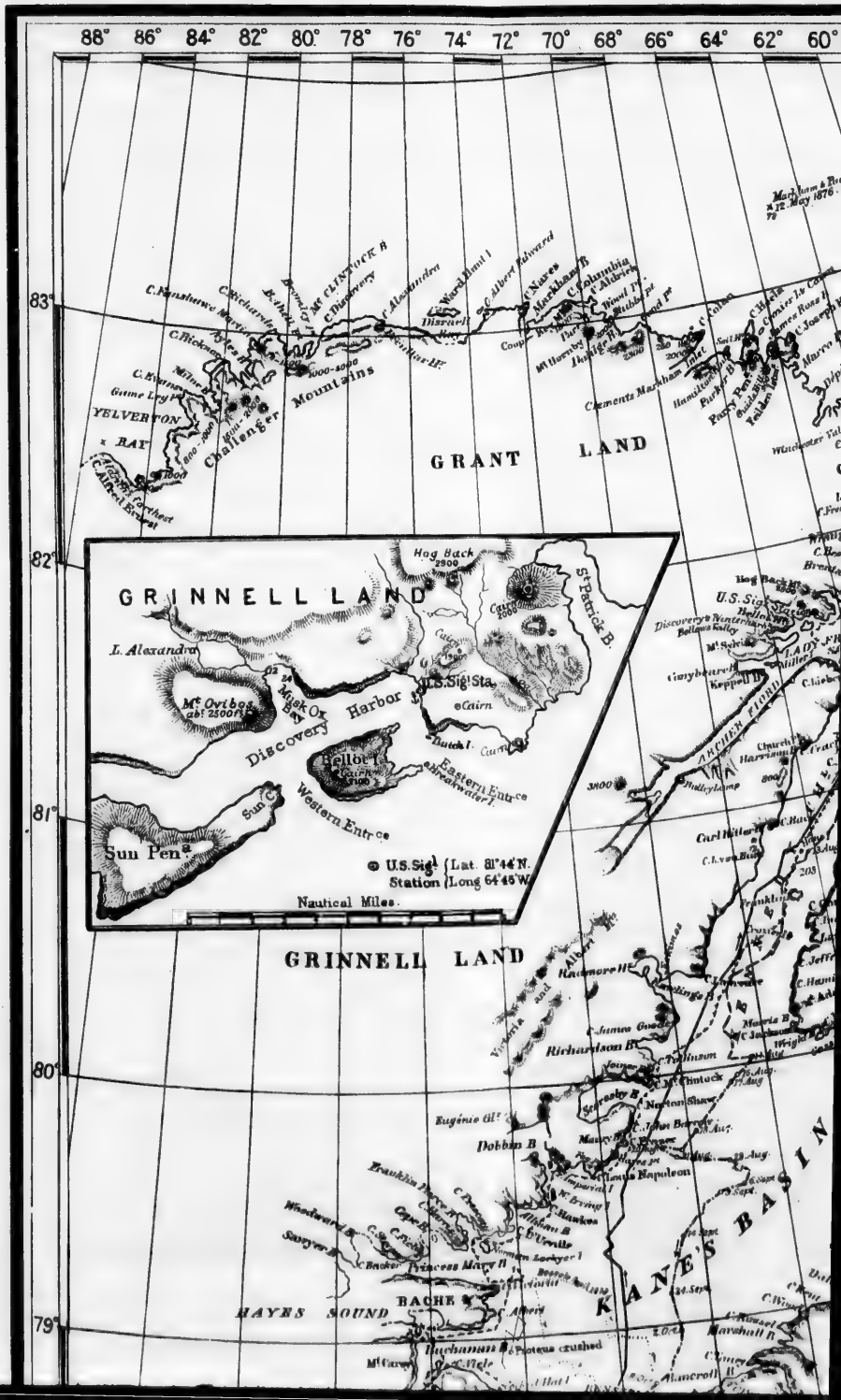
155	**455**	**289**	**297**	**449**	**330**	**222**	**24**	**442**	**67**
43	66	86	106	138	170	214	223	271	316
180	**419**	**117**	**404**	**254**	**498**	**315**	**282**	**349**	
333	363	464	496	519	554	576	593	621	

But the late Rear-Admiral C. H. Davis, U. S. N., the editor of the *Narrative*, cannot be held responsible for this oversight. The pages of this book had not yet gone entirely through the press when his health was failing, and the final revision and correction of Chapters XIX. to XXV., and consequently of the tables of contents also, were entrusted by him to Professor J. E. Nourse, U. S. N., who subsequently edited the narrative of *Hall's Second Arctic Expedition*. This volume, a typographical masterpiece, printed on excellent paper, contains also a considerable number of my woodcuts, which I had placed at the disposal of Professor Nourse. Those on the following named pages are my property: Ptarmigan, p. 71; Eskimo sled, p. 85; Eskimo games (ball and cup), 2 figures, p. 96; dog-skin mittens, p. 107; lance, and parts of the same, 4 figures, p. 121; seal-skin boots and bear-skin mittens, 2 figures, p. 136; harpoon heads, 2 figures, p. 169; ivory and bone combs, 2 figures, p. 177; deer-skin gloves, p. 213; Kajak ornament, p. 216; Eskimo sled, p. 221; bear-tooth toggle, p. 295; snow-goggles, p. 343; seal and deer-skin foot-gear, 4 figures, p. 380; snow-shovel, p. 392; stone pot, p. 408.

They comprise twenty-six illustrations, a considerable percentage of the illustrations contained in the volume. The greater portion has been published in my narrative; a number of others have not yet been printed, and I must guard myself against the suspicion of having plagiarized from the work of Professor Nourse. To avoid further mistake, I consider it my duty to mention that this gentleman placed a number of my illustrations at the disposal of the Rev. Sheldon Jackson, who used them in his "Alaska," published at New York by Dodd, Mead & Co., without date. All those representing ethnological specimens, the originals of which are, without any exception, in the collection of the U. S. National Museum, are not from Alaska, as stated by the Rev. Mr. Jackson, but mostly from Greenland or the Parry Archipelago.

Y.

SMITH SOUND AND VI



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N. LINCOLN
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WHALE SOUND
C. Combermere
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Ross Aug 1818
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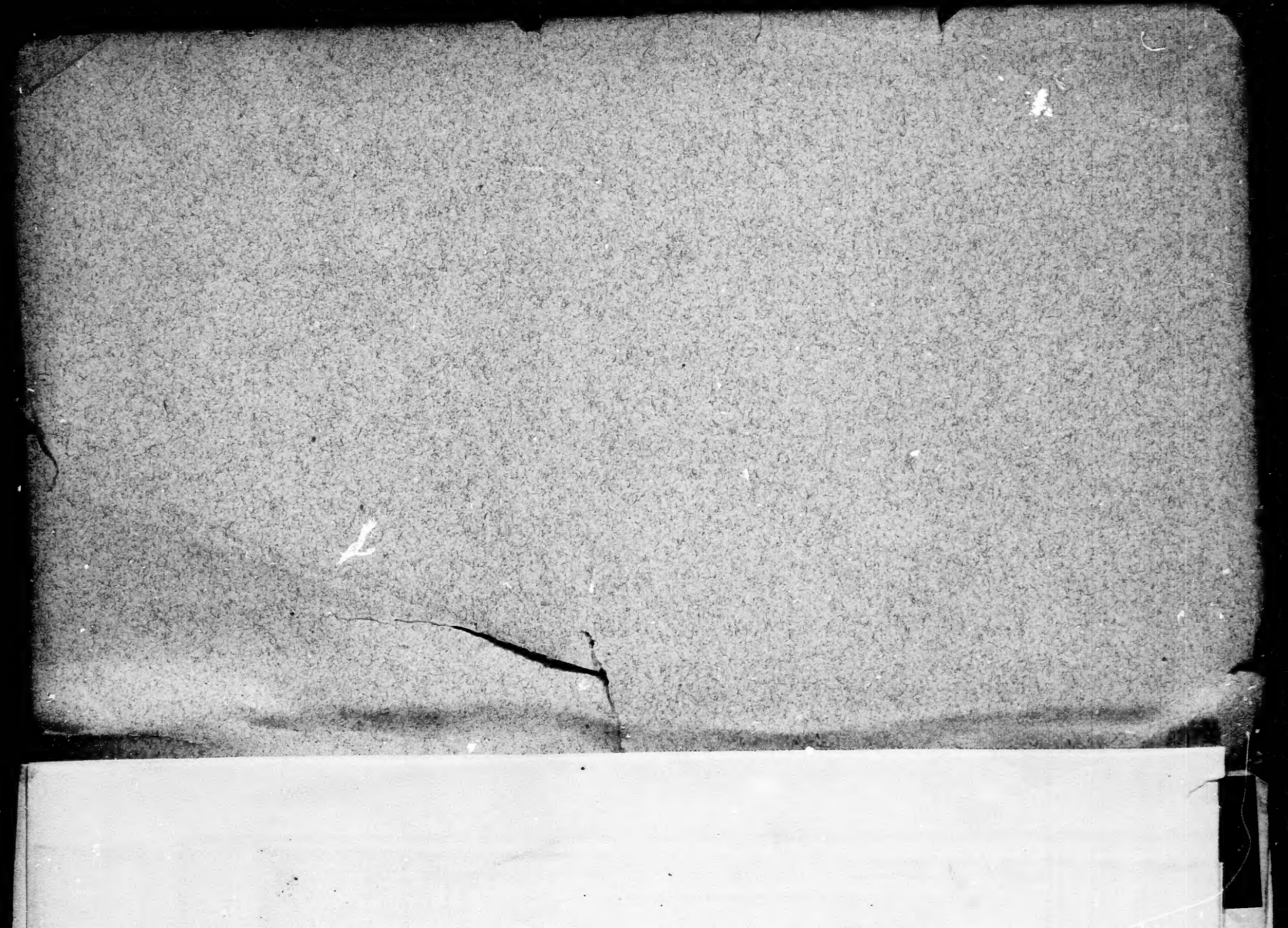

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its twelfth year of existence, trusting as heretofore for its support to the officers of the Navy. The Executive Committee cordially invite the co-operation and aid of their brother officers and of others interested in the Navy, in furtherance of the aim of the Institute, by papers bearing upon topics connected with the naval profession.

Art. IV., Section 2, of the Constitution reads: All officers of the Navy, Marine Corps, and all civil officers attached to the naval service, shall be entitled to become members without ballot, on payment of dues to the Treasurer, or to the Corresponding Secretary on the station. Other persons may become members on election by ballot, under the rules governing the election of honorary and associate members (see Art. IV., Sec. 6), and on payment of dues; provided that the number of members not officially connected with the Navy shall not at any time exceed (50) fifty.

The Proceedings are published quarterly, and may be obtained by non-members upon application to the Secretary at Annapolis, Md. Inventors of articles connected with the naval profession will be afforded an opportunity of explaining and explaining their inventions. A description of such inventions as may be deemed, by the Executive Committee, of use to the service, will be published in the Proceedings.

Single copies of the Proceedings, $1.00. Back numbers and complete sets can be obtained by applying to the Secretary.

Annual subscription for non-members, $3.50. Annual dues for members and associate-members, $3.00. Life membership fee, $30.00.

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I give and bequeath to the Association known as the UNITED STATES NAVAL INSTITUTE, organized October, 1873, at Annapolis, Md., the sum of ..... dollars, to be applied to the uses and purposes of said Association.

If real estate is bequeathed, describe it.